

United States Patent [19]**Adrain****[11] Patent Number: 5,831,669****[45] Date of Patent: *Nov. 3, 1998****[54] FACILITY MONITORING SYSTEM WITH IMAGE MEMORY AND CORRELATION****[76] Inventor:** John B. Adrain, Box 299, Salt Lake City, Utah 84110

[*] Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

[21] Appl. No.: 677,100**[22] Filed: Jul. 9, 1996****[51] Int. Cl.⁶ H04N 7/18****[52] U.S. Cl. 348/143; 348/159**

[58] Field of Search 348/143, 152, 348/155, 156, 159, 161; 382/156, 159; H04N 7/18

[56] References Cited**U.S. PATENT DOCUMENTS**

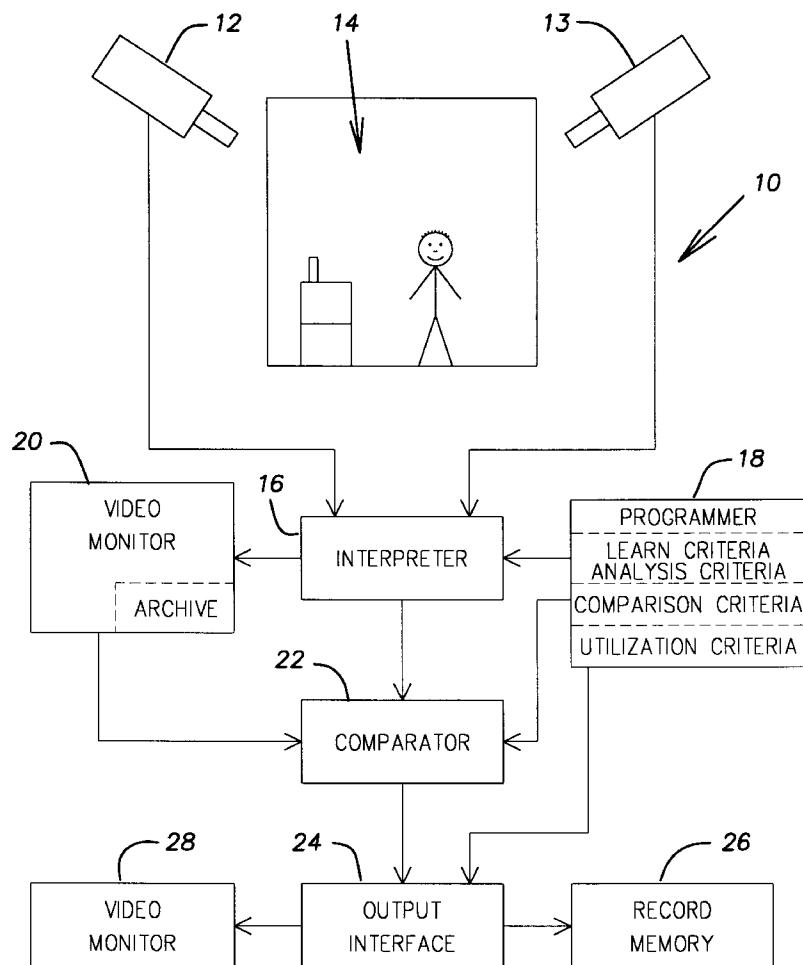
4,185,298 1/1980 Billet et al. .

4,547,897	10/1985	Peterson .
4,704,694	11/1987	Czerniejewski .
4,728,195	3/1988	Silver .
4,972,359	11/1990	Silver et al. .
5,293,428	3/1994	Kondou et al. .
5,367,439	11/1994	Mayer et al. .
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Primary Examiner—Howard Britton
Attorney, Agent, or Firm—Pearne, Gordon, McCoy & Granger LLP

[57] ABSTRACT

A video image of a space is monitored and compared to a reference image. Correlation of the images indicates presence of unwanted persons or objects or the occurrence of unwanted events. When programmed comparison criteria are met, an alarm is activated, the space is displayed on a monitor, and the image is stored in memory. Reference images are stored during dedicated or ongoing learn modes.

20 Claims, 2 Drawing Sheets**A000001**

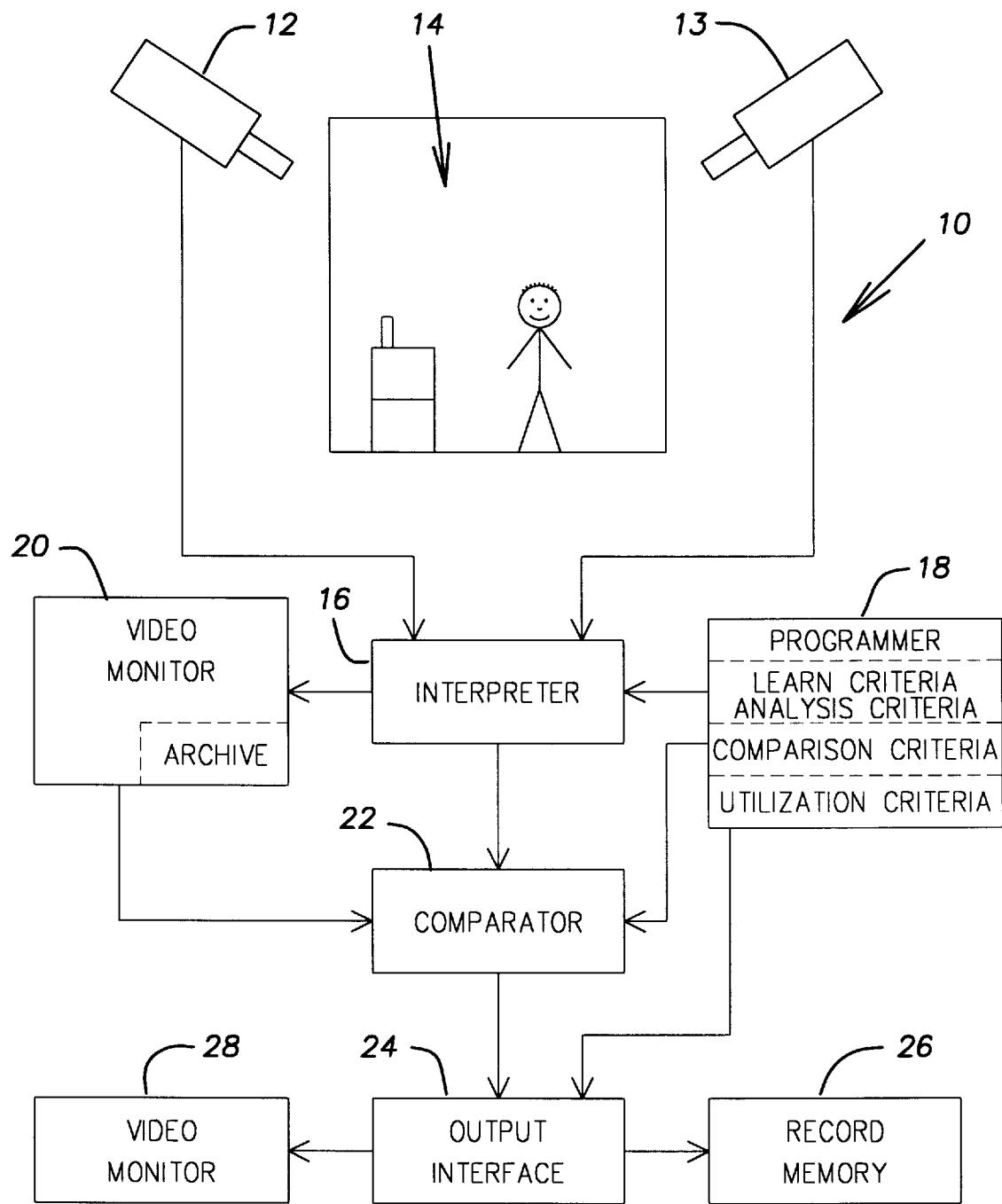


FIG. 1

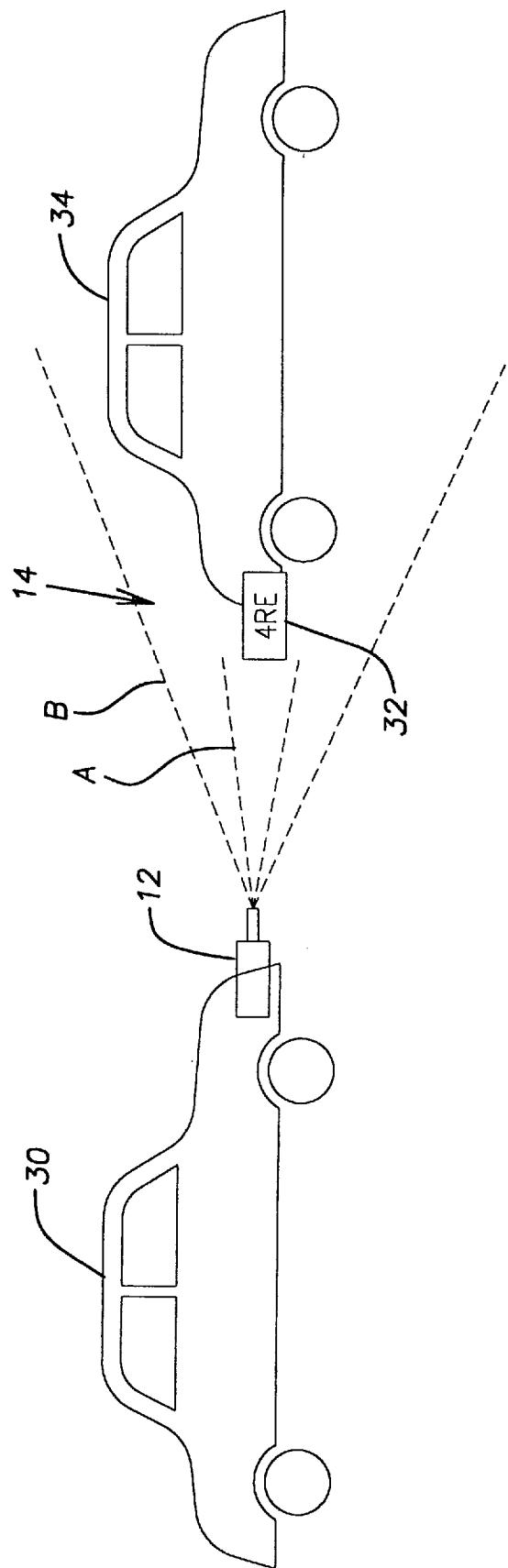


FIG. 2

1

FACILITY MONITORING SYSTEM WITH IMAGE MEMORY AND CORRELATION

BACKGROUND OF THE INVENTION

1. Field of the Invention

This invention relates generally to the field of monitoring and security and specifically to a system that records images and identifies correlation or lack of correlation with the images.

2. Description of the Related Art

Video cameras are used for monitoring activity in myriad locations and applications. Commonly, a person views a display showing a scene viewed by the cameras. A single display might receive input from several cameras or each camera might have a dedicated display. Frequently, the person is responsible for monitoring several displays, in addition to other responsibilities. The person cannot give undivided attention to each monitor. Even if the person is responsible only for monitoring a single display, fatigue, boredom, hypnosis, or other factors can cause the person to miss events shown on the display.

Events recorded by the cameras are frequently stored on tape or by some other memory device for subsequent review. This permits replay and careful review, but monitoring is not automatic and not coincident with the events being recorded.

Machine vision devices employing digital image processing are used in manufacturing to test proper positioning, assembly and construction of parts and components. Numerous images of parts or assemblies are successively compared to reference images. Correlation and other characteristics of the comparisons are determined. If a part or assembly does not meet selected criteria, it is determined to be defective and is removed from the manufacturing operation. Examples of such devices and associated systems are shown in U.S. Pat. Nos. 4,185,298; 4,704,694; 4,728,195; 4,972,359; 5,293,428; 5,367,439; 5,371,690; 5,426,509.

SUMMARY OF THE INVENTION

The present invention provides a monitoring system having a camera adapted for receiving images of a space to be monitored. An interpreter receives image data from the camera, and a reference memory stores reference image data. A comparator is connected for comparing image data from the interpreter to image data from the reference memory according to selected comparison criteria. An output interface reports results of the image data comparisons performed by the comparator.

A programmer is provided for inputting the comparison criteria to the comparator. The programmer is connected for inputting analysis criteria to the interpreter and the interpreter is adapted for analyzing the image data according to the analysis criteria. The programmer is connected for inputting learn criteria to the interpreter and the interpreter is connected for storing image data from the camera in the reference memory according to the learn and analysis criteria. The programmer is connected for inputting learn criteria to the interpreter and the interpreter is connected for storing image data from the camera in the reference memory according to the learn criteria. The programmer is connected for inputting utilization criteria, the output interface being adapted for reporting selected comparison results according the utilization criteria.

A record memory is connected for storing image data from the output interface. The record memory is adapted for storing information associated with the image data stored. A

2

video monitor is provided for displaying images from the output interface. A second camera is connected to provide image data to the interpreter, wherein the interpreter derives a three-dimensional image of the space and the reference memory, comparator, and output interface are adapted for processing three-dimensional image data.

The interpreter is adapted for storing in the reference memory image data from the camera. The interpreter is adapted for periodically storing in the reference memory image data from the camera according to learn criteria. The reference memory is adapted for storing image data for plural images and the comparator is adapted for comparing image data from the interpreter to image data for the plural images from the reference memory according to selected comparison criteria. The camera is mounted to a movable support, such as a vehicle, and the space to be monitored changes according to movement of the support. Alternatively, the camera is mounted to a stationary support. The interpreter is adapted for dividing image data into zones and the comparator is adapted for comparing image data corresponding to the different zones with image data from the reference memory according to different comparison criteria for each zone. The interpreter is adapted for disregarding image data corresponding with a certain zone selected according to selected analysis criteria. The comparator is adapted for sequentially comparing the image data from the different zones and discontinuing comparison of an image upon failure to meet the comparison criteria for the zone being compared. The interpreter is adapted for dividing image data into zones and different criteria are applied to different zones of the image data.

The invention also provides a method of monitoring a space. Method steps include receiving a first set of image data from the space; identifying and selecting a portion of the information to be stored according to analysis and learn criteria; storing the selected information; receiving a second set of image data from the space; identifying and selecting a portion of the second set of image data to be analyzed according to the analysis criteria; comparing the selected portions of the sets of image data to each other so as to determine a correlation of the images; and indicating whether the correlation of the images meets selected comparison criteria.

Additional steps include reporting results of the comparison step according to utilization criteria; establishing the analysis and learn criteria; establishing the comparison criteria; and establishing the utilization criteria. The step of indicating includes recording image data according to utilization criteria. Plural sets of image data are stored and the step of comparing the image data comprises comparison of the plural sets of image data to one of the sets of image data. The image data are sequentially received from different spaces. The step of storing data includes establishing baseline image data and subsequently storing changes from the baseline data. The portions of data selected represent a zone of the space. The steps are repeated for selected data representing a different zone of the space and at least one set of the analysis, learn, and comparison criteria is different from the previous criteria.

The system according to the invention has application in numerous situations where video or human monitoring is presently utilized. In addition, this system has application where video and other forms of monitoring have been ineffective. For example, casinos can use this system for identifying irregularities in the dealing and playing of cards and other games. Commercial facilities can use the system for reliably identifying breaches of security with minimal

3

false alarms. Law enforcement officials can use the system to monitor license plates with mobile or stationary equipment for identifying stolen vehicles.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a block diagram of a monitoring system according to the invention; and

FIG. 2 shows a schematic diagram of another embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, a monitoring system 10 includes cameras 12, 13 for monitoring a space 14. The space 14 can be a room, an entry, a passage, or any other location. The cameras 12, 13 are mounted on stationary supports, such as walls of the space 14. In one embodiment, the camera 12 is a digital video camera translating visible images into digital electric signals. As discussed below, other cameras are also suitable, such as analog or infrared. A single camera can be used for two dimensional images; Two cameras are used for three-dimensional images, wherein an interpreter derives the three-dimensional image from image data received from the two cameras. Additional cameras can be used for monitoring different spaces or different characteristics of the same space. The cameras are connected to input image data to an interpreter 16. The interpreter 16 selects image data from the cameras 12, 13 according to analysis criteria input from a programmer 18. Programming can be performed directly by user inputs provided at the programmer or remotely, for example by a modem using a computer with a program interface. A reference memory 20 receives data from the interpreter 16 according to storage criteria input to the interpreter by the programmer 18. A comparator 22 receives data from the interpreter 16 and reference memory 20 and compares these data according to comparison criteria input by the programmer 18. The comparator 22 determines a correlation between pixels from the reference memory 20 and pixels from the interpreter 16. If the comparator 22 determines that the correlation falls within or outside of a selected range requiring action, results of the comparison are input to an output interface 24, such as an alarm panel, a memory interface, or a video monitor interface. The output interface 24 reports results of the comparison by selecting comparison data to be stored or otherwise utilized by a record memory 26 or monitor 28, for example, connected to receive data from the output interface according to criteria input by the programmer 18. Preferably, the interpreter 16, programmer 18, reference memory 20, comparator 22, and output interface 24 are integrated in a microcomputer and associated software.

Using the programmer 18, a user inputs learn criteria, including analysis and storage criteria for reference images to be stored in the reference memory. For example, the user can instruct the interpreter 16 to identify and store in the reference memory 20 a pixel representation of all stationary objects on a shelf in the space 14 at a selected time. The interpreter 16 identifies the object images meeting the programmed criteria, and stores the images in the reference memory 20. The reference memory can be divided into sections for storing different types of data. The reference memory can include an archive section in which baseline image data are stored. After storing the baseline data, subsequent images can be stored by storing only data that have changed from the baseline. According to user programming, the storing of images can be repeated at

4

selected times or continuously according to the learn criteria. For example, the stationary objects can be identified at the same time every day, or when a person whose image data is in the reference memory appears in the space with a new person, the new person's image data is stored in the reference memory. Also, the learn criteria can be automatically revised to create new learn criteria according to image data from the interpreter and the current learn criteria.

The user also programs analysis criteria for monitoring the space. For example, the interpreter 16 can monitor image data from the camera 12 during certain time periods when the images of the stationary objects are not supposed to be moved.

The user also inputs comparison criteria. Comparison criteria include selecting the images to be compared and a range of correlation in which the monitored image is sufficiently like the reference image for a particular purpose. For example, stationary object images and monitored images are compared to determine whether any object previously identified as stationary is not in its previous location. Image data from the interpreter and the reference memory are compared by the comparator 22 according to the comparison criteria to determine correlation of the images. For example, if the location of an object in the image data from the interpreter is not the same as the location of the same object in the reference memory, then the comparator sends an alarm signal to the output interface 24 indicating an alarm condition. Sensitivity of the correlation can be adjusted. For example, the alarm condition can occur on any movement of an object or only on complete absence of an object from the space. The comparison criteria can include events or movements as well as stationary patterns. For example, a person's hand would be an acceptable stationary pattern, but a pixel pattern representing sudden movement of the hand, such as striking something, would represent an impermissible event causing an alarm. The alarm signal can include an image of the space, an identification of the space or the object, the time of the signal, or any other signal indicating that the comparison criteria have been met or not met, as is appropriate. The output interface 24 selects and/or translates the appropriate signals and forwards them to output devices. For example, an audible alarm sounds and the monitor 28 shows the video image of the space 14 when the object is moved, and the image, date and time of the movement of the object is recorded in the record memory 26. Multiple monitoring system components can be connected to a single output interface and monitor to monitor different spaces or different parts of a space. When an alarm condition arises in one space, its output is sent to the monitor and can be augmented by other information such as sound from the space being monitored and information about the space or condition.

Learning and analysis can be performed separately or coincidentally. Learning can be accomplished directly by entering a learn only mode and recording images in the reference memory. Learning can also be accomplished indirectly, for example by association of new images with previously learned images or by receiving new images during permitted learning periods that coincide with monitoring periods.

Referring to FIG. 2, the camera 12 can be mounted on a mobile support, such as a vehicle 30. The space 14 and objects 32 being monitored change according to movement of the vehicle 30. For example, the camera can be mounted on a police car and programmed to monitor license plate numbers. The reference memory stores license numbers for stolen cars. Analysis is limited to consistently sized characters within a specified boundary, that is the rectangular shape

5

of the license plate. When the object 32 meets the analysis criteria of a license plate, the number is compared to the numbers in the reference memory. When the comparison finds a match, an appropriate alarm indicates discovery of a stolen car to officers in the police car. Information about the car and possible occupants can be displayed as well.

The invention, as shown for example in FIGS. 1 and 2, can be used in numerous methods of operation. The license plate example utilizes a high degree of correlation between the reference image and the monitored image. Other aspects of the invention, discussed previously and below, utilize lack of correlation between the reference and monitored images to trigger an alarm condition. Combinations of these aspects can also be used for different objects or spaces monitored by the same system.

A limited access entry or passage, an office or workspace, or a home can be monitored. The learn criteria identify persons permitted to be in the monitored space, image data of their faces being stored in the reference memory. The space monitored is generally consistent so that the analysis criteria ignore the environment and limit the analysis to the faces of persons in the space. The comparison criteria are set to identify unauthorized persons in the space according to comparison of persons in the space with persons in the reference memory. The comparison allows for variations in appearance, such as changes in hair style or facial expressions, by allowing pixel comparisons to vary within a range and by focusing on less changeable parts, such as the nose.

Sensitivity of the correlation can be varied within a space being monitored. Image data for a space can be divided into zones in which different learn, analysis, comparison, and/or utilization criteria apply. For example, monitoring roads to locate license plates, as described with reference to FIG. 2, can also include monitoring the object vehicles 34. License plate characters are uniform, so close correlation of the reference and object in zone A is desired. The color and general outline of the object vehicle can also be analyzed, however, lesser correlation is desired in zone B because different lighting can affect color and the amount of data required for the comparison can be limited. Also, assuming the license plate characters match, close correlation of the vehicle comparison may not be necessary. An alternative analysis and comparison would identify a license plate match in zone A and then compare the vehicle outline in zone B. If the vehicle outline does not sufficiently correlate with the image data corresponding to the license plate number, the output interface would report that the license plate has been switched from the vehicle on which the plate is supposed to be mounted.

Images from different zones can be compared sequentially. The results of a comparison in one zone can affect whether and how a subsequent comparison is performed. For example, the results of a comparison in one zone can determine which zone and/or what comparison criteria are used for a subsequent comparison.

Another method monitors a consistent space, with many different objects and persons. The analysis is limited to specifically defined movements or events possibly within a specified zone. For example, cheating at a casino black jack table is monitored by identifying cards that move outside a selected zone on the table. Also, a person's hand or arm that reaches from the players' side of the table into a forbidden zone will trigger an alarm. However, the dealer's arms and the movement of cards in the playing zone are ignored. Events occurring away from the table are also ignored

6

although they might be recorded for the purpose of identifying the offending player.

In some applications, all but very specific events can be ignored. For example, bank employees can be trained to make a certain movement during a robbery. To the uninitiated, the signal appears innocuous, but the monitoring system is programmed to recognize the movement and trigger an alarm. Like a password, the movement can be changed and accordingly reprogrammed in the system.

Data other than visual images can also be analyzed. For example, thermal images can be used to sense overheating of equipment or fires in facilities. Micropower impulse radar (MIR) can be used to monitor spaces through smoke, walls, or other opaque materials. Different types of cameras or cameras collecting different types of image data can be combined. For example, a thermal camera can monitor a space to sense a fire. A radar camera can monitor the same space to sense whether floors or walls have collapsed due to the fire.

Monitoring can be accomplished in real time or using images collected previously. For example, an amusement park can use cameras located at different points in the park. Analysis of traffic flow can be analyzed in real time based on criteria selected prior to monitoring. Results can be used immediately to correct for unwanted conditions. Alternatively, the cameras can collect image data for storage. At a later time, comparison can be made based on criteria selected at the later time and the comparison results used to establish a statistical database for future planning.

The present disclosure describes several embodiments of the invention, however, the invention is not limited to these embodiments. Other variations are contemplated to be within the spirit and scope of the invention and appended claims.

What is claimed is:

1. A monitoring system comprising:
a movably mounted camera adapted for receiving images of a space to be monitored;
an interpreter for receiving image data from the camera;
a reference memory for storing reference image data;
a comparator connected for comparing image data from the interpreter to image data from the reference memory according to selected comparison criteria, wherein the interpreter and comparator cooperate to select recognizable portions of image data among unrecognized portions of image data in the space being monitored, the selected image portions being compared to the image data in the reference memory; and
an output interface for reporting results of the image data comparisons performed by the comparator.
2. A system according to claim 1 further comprising a programmer for inputting the comparison criteria to the comparator.
3. A system according to claim 2 wherein the programmer is connected for inputting analysis criteria to the interpreter and the interpreter is adapted for analyzing the image data according to the analysis criteria.
4. A system according to claim 3 wherein the programmer is connected for inputting learn criteria to the interpreter and the interpreter is connected for storing image data from the camera in the reference memory according to the learn and analysis criteria.
5. A system according to claim 2 wherein the programmer is connected for inputting learn criteria to the interpreter and the interpreter is connected for storing image data from the camera in the reference memory according to the learn criteria.

7

6. A system according to claim 2 wherein the programmer is connected for inputting utilization criteria, the output interface being adapted for reporting selected comparison results according the utilization criteria.

7. A system according to claim 1 wherein the camera is 5 mounted on a vehicle.

8. A system according to claim 1 wherein the record memory is adapted for storing information associated with the image data stored.

9. A system according to claim 1 wherein the interpreter 10 selects images according to analysis criteria so that only the selected images are input to the comparator for comparison to reference images.

10. A system according to claim 9 wherein the selected images represent only portions of a larger image.

11. A monitoring system comprising:

a movably mounted camera adapted for receiving images of a space to be monitored;
an interpreter for receiving image data from the camera; a reference memory for storing reference image data for plural images and a comparator adapted for comparing image data from the interpreter to image data for the plural images from the reference memory according to selected comparison criteria, wherein the interpreter and comparator cooperate to select recognizable portions of image data among unrecognized portions of image data in the space being monitored, the selected image portions being compared to the image data in the reference memory; and

an output interface for reporting results of the image data comparisons performed by the comparator.

12. A method of monitoring a space comprising the steps of:

receiving a first set of image data from the space representing plural images;

identifying and selecting a portion of the information to be stored according to analysis and learn criteria;

8

storing the selected information;
receiving a second set of image data from the space;
identifying and selecting a portion of the second set of image data to be analyzed according to the analysis criteria, wherein the selected portion represents a recognizable portion of image data among unrecognized portions of image data in the space being monitored;
comparing the selected portions of the sets of image data to each other so as to compare the second set of image data to the plural images of the first set and determine a correlation of the images; and
indicating whether the correlation of the images meets selected comparison criteria.

13. A method according to claim 12 further comprising the step of reporting results of the comparison step according to utilization criteria and augmenting the reporting with identifying information.

14. A method according to claim 12 further comprising 20 the step of establishing the analysis and learn criteria.

15. A method according to claim 12 further comprising the step of establishing the comparison criteria.

16. A method according to claim 12 wherein the image data are sequentially received from different spaces.

25 17. A method according to claim 12 wherein the step of storing data includes establishing baseline image data and subsequently storing changes from the baseline data.

18. A method according to claim 12 wherein the portions of data selected represent a zone of the space.

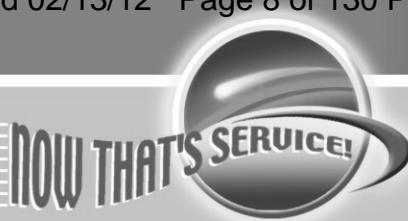
30 19. A method according to claim 18 wherein the steps are repeated for selected data representing a different zone of the space and at least one set of the analysis, learn, and comparison criteria is different from the previous criteria.

20. A method according to claim 12 wherein the comparison of image data is repeated to distinguish between movements based on a series of sequential images.

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- C. Printed Patent
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9	Class
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SERIAL NUMBER 08/677,100	FILING DATE 07/09/96	CLASS 258 248	SUBCLASS 142
		GROUP ART UNIT 2615	EXAMINER Howard BRITTON

APPLICANTS JOHN B. ADRAIN, SALT LAKE CITY, UT.

CONTINUING DATA***

VERIFIED

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FOREIGN/PCT APPLICATIONS***

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***** SMALL ENTITY *****

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TITLE

FACILITY MONITORING SYSTEM WITH IMAGE MEMORY AND CORRELATION

U.S. DEPT. OF COMM./PAT. & TM—PTO-436L (Rev.12-94)

PARTS OF APPLICATION FILED SEPARATELY		T Rose 6/8/98 Applications Examiner	
NOTICE OF ALLOWANCE MAILED <i>6/15/98</i>		CLAIMS ALLOWED	
		Total Claims 20	Print Claim 1
ISSUE FEE Amount Due \$100.00 <i>8-28-98</i>		DRAWING	
		Sheets Drwg. 2	Figs. Drwg. 2
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PATENT APPLICATION



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CONTENTS

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1. Application	<u>2drags.</u>	papers.	<u>7-9-96.</u>
2. <u>Chg Art</u>			<u>1-13-97</u>
1-6-97	3. <u>Rej (3mos)</u>		<u>4-21-97</u>
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EXAMINER		38 8/19/96
TYPIST		5.11 8/20/96
VERIFIER	100	8.29-96
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Claim	Date
Final	Original
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SYMBOLS

✓	Rejected
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-	(Through number) Canceled
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INDEX OF CLAIMS

Claim	Date
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SYMBOLS

✓	Rejected
=	Allowed
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Class	Sub.	Date	Exmr.
348	143 152 155 156 159 161	12/23/96 	ff
382	156 159	12/23/96 	ff
348	143 152 155 156 159 161	7/21/97 	ff
382	156 159	7/21/97 	ff
Ar 1404N	date 7/18	6 2 98	B

SEARCH NOTES

Examiner	Date	Exmr.
Howard Britton AV2615 CL 348	12/23/96 	ff
Vy Le AV2615 CL 348	12/28/96 	ff
Howard Britton AV2615 CL 348	7/21/97 	ff

INTERFERENCE SEARCHED

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APPLICANT'S NAME (PLEASE PRINT)			
J. B. Adair			
REISSUE, ORIGINAL PATENT NUMBER			
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GROUP ART. UNIT		ASSISTANT EXAMINER (PLEASE STAMP OR PRINT FULL NAME)	
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ISSUE CLASSIFICATION SLIP			
PTO 270 (REV. 5-91)		U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	

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United States Patent [19]

Adrain

[11] **Patent Number:** **5,831,669**
[45] **Date of Patent:** ***Nov. 3, 1998**

[54] **FACILITY MONITORING SYSTEM WITH IMAGE MEMORY AND CORRELATION**

[76] Inventor: **John B. Adrain**, Box 299, Salt Lake City, Utah 84110

[*] Notice: This patent issued on a continued prosecution application filed under 37 CFR 1.53(d), and is subject to the twenty year patent term provisions of 35 U.S.C. 154(a)(2).

[21] Appl. No.: **677,100**

[22] Filed: **Jul. 9, 1996**

[51] **Int. Cl.⁶** **H04N 7/18**

[52] **U.S. Cl.** **348/143; 348/159**

[58] **Field of Search** **348/143, 152, 348/155, 156, 159, 161; 382/156, 159; H04N 7/18**

4,547,897	10/1985	Peterson .
4,704,694	11/1987	Czerniejewski .
4,728,195	3/1988	Silver .
4,972,359	11/1990	Silver et al. .
5,293,428	3/1994	Kondou et al. .
5,367,439	11/1994	Mayer et al. .
5,371,690	12/1994	Engel et al. .
5,426,509	6/1995	Peplinski .

Primary Examiner—Howard Britton

Attorney, Agent, or Firm—Pearne, Gordon, McCoy & Granger LLP

[57] **ABSTRACT**

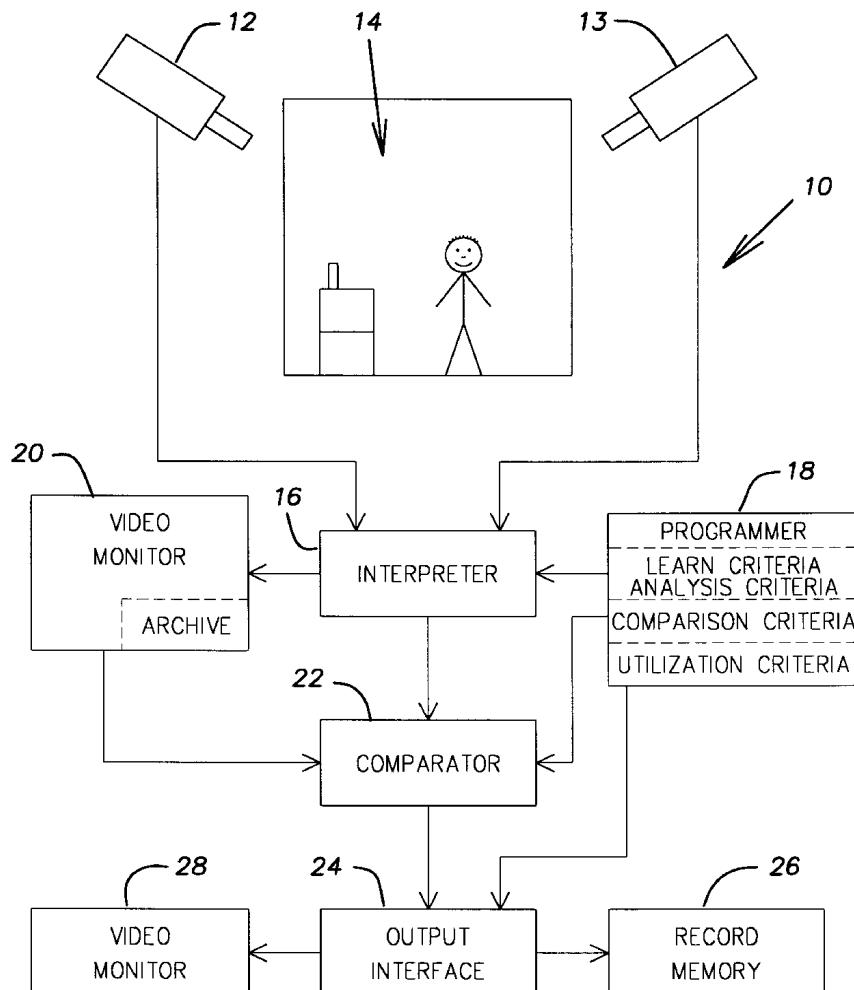
A video image of a space is monitored and compared to a reference image. Correlation of the images indicates presence of unwanted persons or objects or the occurrence of unwanted events. When programmed comparison criteria are met, an alarm is activated, the space is displayed on a monitor, and the image is stored in memory. Reference images are stored during dedicated or ongoing learn modes.

[56] **References Cited**

U.S. PATENT DOCUMENTS

4,185,298 1/1980 Billet et al. .

20 Claims, 2 Drawing Sheets



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U.S. Patent

Nov. 3, 1998

Sheet 1 of 2

5,831,669

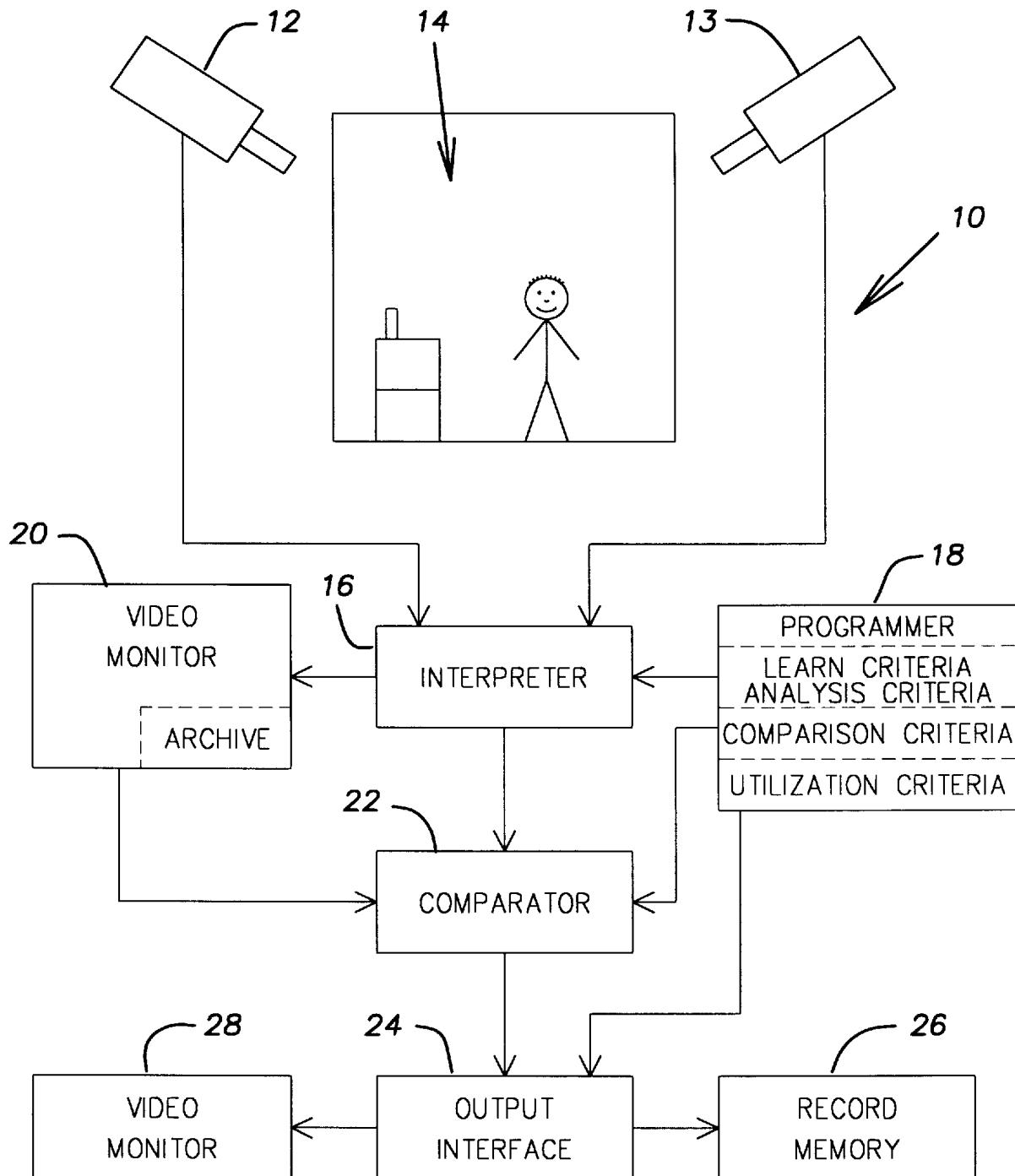


FIG. 1

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U.S. Patent

Nov. 3, 1998

Sheet 2 of 2

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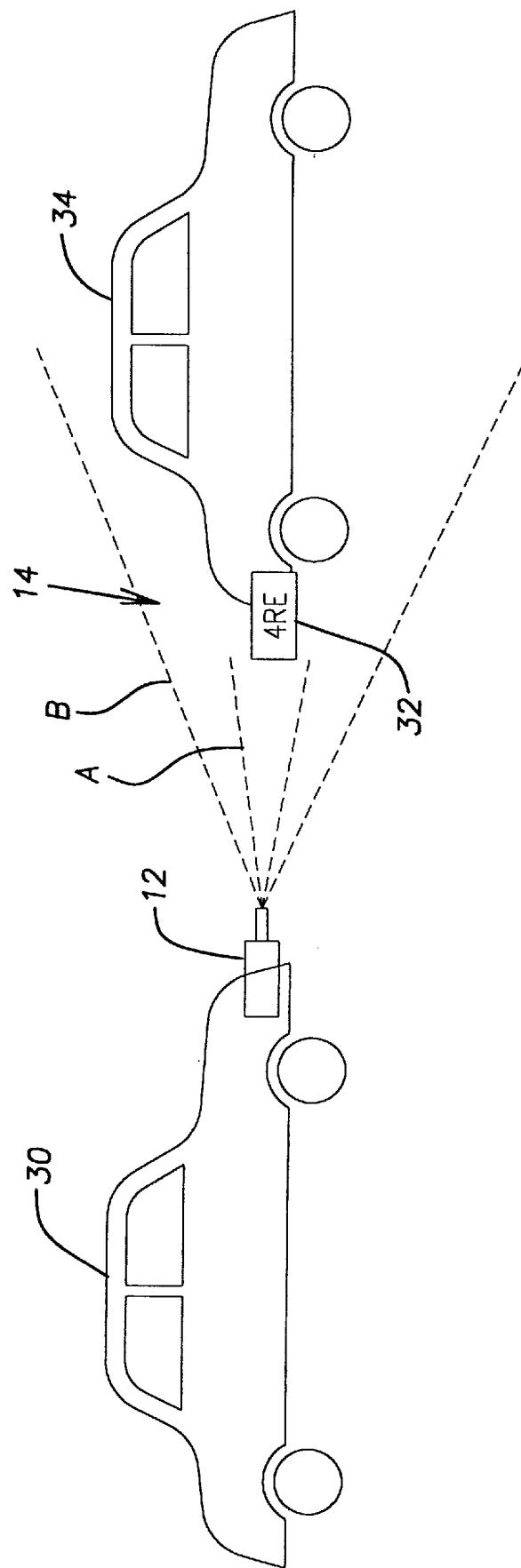


FIG. 2

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1**FACILITY MONITORING SYSTEM WITH IMAGE MEMORY AND CORRELATION****BACKGROUND OF THE INVENTION****1. Field of the Invention**

This invention relates generally to the field of monitoring and security and specifically to a system that records images and identifies correlation or lack of correlation with the images.

2. Description of the Related Art

Video cameras are used for monitoring activity in myriad locations and applications. Commonly, a person views a display showing a scene viewed by the cameras. A single display might receive input from several cameras or each camera might have a dedicated display. Frequently, the person is responsible for monitoring several displays, in addition to other responsibilities. The person cannot give undivided attention to each monitor. Even if the person is responsible only for monitoring a single display, fatigue, boredom, hypnosis, or other factors can cause the person to miss events shown on the display.

Events recorded by the cameras are frequently stored on tape or by some other memory device for subsequent review. This permits replay and careful review, but monitoring is not automatic and not coincident with the events being recorded.

Machine vision devices employing digital image processing are used in manufacturing to test proper positioning, assembly and construction of parts and components. Numerous images of parts or assemblies are successively compared to reference images. Correlation and other characteristics of the comparisons are determined. If a part or assembly does not meet selected criteria, it is determined to be defective and is removed from the manufacturing operation. Examples of such devices and associated systems are shown in U.S. Pat. Nos. 4,185,298; 4,704,694; 4,728,195; 4,972,359; 5,293,428; 5,367,439; 5,371,690; 5,426,509.

SUMMARY OF THE INVENTION

The present invention provides a monitoring system having a camera adapted for receiving images of a space to be monitored. An interpreter receives image data from the camera, and a reference memory stores reference image data. A comparator is connected for comparing image data from the interpreter to image data from the reference memory according to selected comparison criteria. An output interface reports results of the image data comparisons performed by the comparator.

A programmer is provided for inputting the comparison criteria to the comparator. The programmer is connected for inputting analysis criteria to the interpreter and the interpreter is adapted for analyzing the image data according to the analysis criteria. The programmer is connected for inputting learn criteria to the interpreter and the interpreter is connected for storing image data from the camera in the reference memory according to the learn and analysis criteria. The programmer is connected for inputting learn criteria to the interpreter and the interpreter is connected for storing image data from the camera in the reference memory according to the learn criteria. The programmer is connected for inputting utilization criteria, the output interface being adapted for reporting selected comparison results according to the utilization criteria.

A record memory is connected for storing image data from the output interface. The record memory is adapted for storing information associated with the image data stored. A

2

video monitor is provided for displaying images from the output interface. A second camera is connected to provide image data to the interpreter, wherein the interpreter derives a three-dimensional image of the space and the reference memory, comparator, and output interface are adapted for processing three-dimensional image data.

The interpreter is adapted for storing in the reference memory image data from the camera. The interpreter is adapted for periodically storing in the reference memory image data from the camera according to learn criteria. The reference memory is adapted for storing image data for plural images and the comparator is adapted for comparing image data from the interpreter to image data for the plural images from the reference memory according to selected comparison criteria. The camera is mounted to a movable support, such as a vehicle, and the space to be monitored changes according to movement of the support. Alternatively, the camera is mounted to a stationary support. The interpreter is adapted for dividing image data into zones and the comparator is adapted for comparing image data corresponding to the different zones with image data from the reference memory according to different comparison criteria for each zone. The interpreter is adapted for disregarding image data corresponding with a certain zone selected according to selected analysis criteria. The comparator is adapted for sequentially comparing the image data from the different zones and discontinuing comparison of an image upon failure to meet the comparison criteria for the zone being compared. The interpreter is adapted for dividing image data into zones and different criteria are applied to different zones of the image data.

The invention also provides a method of monitoring a space. Method steps include receiving a first set of image data from the space; identifying and selecting a portion of the information to be stored according to analysis and learn criteria; storing the selected information; receiving a second set of image data from the space; identifying and selecting a portion of the second set of image data to be analyzed according to the analysis criteria; comparing the selected portions of the sets of image data to each other so as to determine a correlation of the images; and indicating whether the correlation of the images meets selected comparison criteria.

Additional steps include reporting results of the comparison step according to utilization criteria; establishing the analysis and learn criteria; establishing the comparison criteria; and establishing the utilization criteria. The step of indicating includes recording image data according to utilization criteria. Plural sets of image data are stored and the step of comparing the image data comprises comparison of the plural sets of image data to one of the sets of image data. The image data are sequentially received from different spaces. The step of storing data includes establishing baseline image data and subsequently storing changes from the baseline data. The portions of data selected represent a zone of the space. The steps are repeated for selected data representing a different zone of the space and at least one set of the analysis, learn, and comparison criteria is different from the previous criteria.

The system according to the invention has application in numerous situations where video or human monitoring is presently utilized. In addition, this system has application where video and other forms of monitoring have been ineffective. For example, casinos can use this system for identifying irregularities in the dealing and playing of cards and other games. Commercial facilities can use the system for reliably identifying breaches of security with minimal

false alarms. Law enforcement officials can use the system to monitor license plates with mobile or stationary equipment for identifying stolen vehicles.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. 1 shows a block diagram of a monitoring system according to the invention; and

FIG. 2 shows a schematic diagram of another embodiment of the invention.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

Referring to FIG. 1, a monitoring system 10 includes cameras 12, 13 for monitoring a space 14. The space 14 can be a room, an entry, a passage, or any other location. The cameras 12, 13 are mounted on stationary supports, such as walls of the space 14. In one embodiment, the camera 12 is a digital video camera translating visible images into digital electric signals. As discussed below, other cameras are also suitable, such as analog or infrared. A single camera can be used for two dimensional images; Two cameras are used for three-dimensional images, wherein an interpreter derives the three-dimensional image from image data received from the two cameras. Additional cameras can be used for monitoring different spaces or different characteristics of the same space. The cameras are connected to input image data to an interpreter 16. The interpreter 16 selects image data from the cameras 12, 13 according to analysis criteria input from a programmer 18. Programming can be performed directly by user inputs provided at the programmer or remotely, for example by a modem using a computer with a program interface. A reference memory 20 receives data from the interpreter 16 according to storage criteria input to the interpreter by the programmer 18. A comparator 22 receives data from the interpreter 16 and reference memory 20 and compares these data according to comparison criteria input by the programmer 18. The comparator 22 determines a correlation between pixels from the reference memory 20 and pixels from the interpreter 16. If the comparator 22 determines that the correlation falls within or outside of a selected range requiring action, results of the comparison are input to an output interface 24, such as an alarm panel, a memory interface, or a video monitor interface. The output interface 24 reports results of the comparison by selecting comparison data to be stored or otherwise utilized by a record memory 26 or monitor 28, for example, connected to receive data from the output interface according to criteria input by the programmer 18. Preferably, the interpreter 16, programmer 18, reference memory 20, comparator 22, and output interface 24 are integrated in a microcomputer and associated software.

Using the programmer 18, a user inputs learn criteria, including analysis and storage criteria for reference images to be stored in the reference memory. For example, the user can instruct the interpreter 16 to identify and store in the reference memory 20 a pixel representation of all stationary objects on a shelf in the space 14 at a selected time. The interpreter 16 identifies the object images meeting the programmed criteria, and stores the images in the reference memory 20. The reference memory can be divided into sections for storing different types of data. The reference memory can include an archive section in which baseline image data are stored. After storing the baseline data, subsequent images can be stored by storing only data that have changed from the baseline. According to user programming, the storing of images can be repeated at

selected times or continuously according to the learn criteria. For example, the stationary objects can be identified at the same time every day, or when a person whose image data is in the reference memory appears in the space with a new person, the new person's image data is stored in the reference memory. Also, the learn criteria can be automatically revised to create new learn criteria according to image data from the interpreter and the current learn criteria.

The user also programs analysis criteria for monitoring the space. For example, the interpreter 16 can monitor image data from the camera 12 during certain time periods when the images of the stationary objects are not supposed to be moved.

The user also inputs comparison criteria. Comparison criteria include selecting the images to be compared and a range of correlation in which the monitored image is sufficiently like the reference image for a particular purpose. For example, stationary object images and monitored images are compared to determine whether any object previously identified as stationary is not in its previous location. Image data from the interpreter and the reference memory are compared by the comparator 22 according to the comparison criteria to determine correlation of the images. For example, if the location of an object in the image data from the interpreter is not the same as the location of the same object in the reference memory, then the comparator sends an alarm signal to the output interface 24 indicating an alarm condition. Sensitivity of the correlation can be adjusted. For example, the alarm condition can occur on any movement of an object or only on complete absence of an object from the space. The comparison criteria can include events or movements as well as stationary patterns. For example, a person's hand would be an acceptable stationary pattern, but a pixel pattern representing sudden movement of the hand, such as striking something, would represent an impermissible event causing an alarm. The alarm signal can include an image of the space, an identification of the space or the object, the time of the signal, or any other signal indicating that the comparison criteria have been met or not met, as is appropriate. The output interface 24 selects and/or translates the appropriate signals and forwards them to output devices. For example, an audible alarm sounds and the monitor 28 shows the video image of the space 14 when the object is moved, and the image, date and time of the movement of the object is recorded in the record memory 26. Multiple monitoring system components can be connected to a single output interface and monitor to monitor different spaces or different parts of a space. When an alarm condition arises in one space, its output is sent to the monitor and can be augmented by other information such as sound from the space being monitored and information about the space or condition.

Learning and analysis can be performed separately or coincidentally. Learning can be accomplished directly by entering a learn only mode and recording images in the reference memory. Learning can also be accomplished indirectly, for example by association of new images with previously learned images or by receiving new images during permitted learning periods that coincide with monitoring periods.

Referring to FIG. 2, the camera 12 can be mounted on a mobile support, such as a vehicle 30. The space 14 and objects 32 being monitored change according to movement of the vehicle 30. For example, the camera can be mounted on a police car and programmed to monitor license plate numbers. The reference memory stores license numbers for stolen cars. Analysis is limited to consistently sized characters within a specified boundary, that is the rectangular shape

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of the license plate. When the object 32 meets the analysis criteria of a license plate, the number is compared to the numbers in the reference memory. When the comparison finds a match, an appropriate alarm indicates discovery of a stolen car to officers in the police car. Information about the car and possible occupants can be displayed as well.

The invention, as shown for example in FIGS. 1 and 2, can be used in numerous methods of operation. The license plate example utilizes a high degree of correlation between the reference image and the monitored image. Other aspects of the invention, discussed previously and below, utilize lack of correlation between the reference and monitored images to trigger an alarm condition. Combinations of these aspects can also be used for different objects or spaces monitored by the same system.

A limited access entry or passage, an office or workspace, or a home can be monitored. The learn criteria identify persons permitted to be in the monitored space, image data of their faces being stored in the reference memory. The space monitored is generally consistent so that the analysis criteria ignore the environment and limit the analysis to the faces of persons in the space. The comparison criteria are set to identify unauthorized persons in the space according to comparison of persons in the space with persons in the reference memory. The comparison allows for variations in appearance, such as changes in hair style or facial expressions, by allowing pixel comparisons to vary within a range and by focusing on less changeable parts, such as the nose.

Sensitivity of the correlation can be varied within a space being monitored. Image data for a space can be divided into zones in which different learn, analysis, comparison, and/or utilization criteria apply. For example, monitoring roads to locate license plates, as described with reference to FIG. 2, can also include monitoring the object vehicles 34. License plate characters are uniform, so close correlation of the reference and object in zone A is desired. The color and general outline of the object vehicle can also be analyzed, however, lesser correlation is desired in zone B because different lighting can affect color and the amount of data required for the comparison can be limited. Also, assuming the license plate characters match, close correlation of the vehicle comparison may not be necessary. An alternative analysis and comparison would identify a license plate match in zone A and then compare the vehicle outline in zone B. If the vehicle outline does not sufficiently correlate with the image data corresponding to the license plate number, the output interface would report that the license plate has been switched from the vehicle on which the plate is supposed to be mounted.

Images from different zones can be compared sequentially. The results of a comparison in one zone can affect whether and how a subsequent comparison is performed. For example, the results of a comparison in one zone can determine which zone and/or what comparison criteria are used for a subsequent comparison.

Another method monitors a consistent space, with many different objects and persons. The analysis is limited to specifically defined movements or events possibly within a specified zone. For example, cheating at a casino black jack table is monitored by identifying cards that move outside a selected zone on the table. Also, a person's hand or arm that reaches from the players' side of the table into a forbidden zone will trigger an alarm. However, the dealer's arms and the movement of cards in the playing zone are ignored. Events occurring away from the table are also ignored.

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although they might be recorded for the purpose of identifying the offending player.

In some applications, all but very specific events can be ignored. For example, bank employees can be trained to make a certain movement during a robbery. To the uninitiated, the signal appears innocuous, but the monitoring system is programmed to recognize the movement and trigger an alarm. Like a password, the movement can be changed and accordingly reprogrammed in the system.

10 Data other than visual images can also be analyzed. For example, thermal images can be used to sense overheating of equipment or fires in facilities. Micropower impulse radar (MIR) can be used to monitor spaces through smoke, walls, or other opaque materials. Different types of cameras or cameras collecting different types of image data can be combined. For example, a thermal camera can monitor a space to sense a fire. A radar camera can monitor the same space to sense whether floors or walls have collapsed due to the fire.

15 Monitoring can be accomplished in real time or using images collected previously. For example, an amusement park can use cameras located at different points in the park. Analysis of traffic flow can be analyzed in real time based on criteria selected prior to monitoring. Results can be used immediately to correct for unwanted conditions. Alternatively, the cameras can collect image data for storage. At a later time, comparison can be made based on criteria selected at the later time and the comparison results used to establish a statistical database for future planning.

20 The present disclosure describes several embodiments of the invention, however, the invention is not limited to these embodiments. Other variations are contemplated to be within the spirit and scope of the invention and appended claims.

25 What is claimed is:

30 1. A monitoring system comprising:
35 a movably mounted camera adapted for receiving images of a space to be monitored;
40 an interpreter for receiving image data from the camera; a reference memory for storing reference image data; a comparator connected for comparing image data from the interpreter to image data from the reference memory according to selected comparison criteria, wherein the interpreter and comparator cooperate to select recognizable portions of image data among unrecognized portions of image data in the space being monitored, the selected image portions being compared to the image data in the reference memory; and
45 an output interface for reporting results of the image data comparisons performed by the comparator.

50 2. A system according to claim 1 further comprising a programmer for inputting the comparison criteria to the comparator.

55 3. A system according to claim 2 wherein the programmer is connected for inputting analysis criteria to the interpreter and the interpreter is adapted for analyzing the image data according to the analysis criteria.

60 4. A system according to claim 3 wherein the programmer is connected for inputting learn criteria to the interpreter and the interpreter is connected for storing image data from the camera in the reference memory according to the learn and analysis criteria.

65 5. A system according to claim 2 wherein the programmer is connected for inputting learn criteria to the interpreter and the interpreter is connected for storing image data from the camera in the reference memory according to the learn criteria.

5,831,669

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6. A system according to claim **2** wherein the programmer is connected for inputting utilization criteria, the output interface being adapted for reporting selected comparison results according the utilization criteria.

7. A system according to claim **1** wherein the camera is mounted on a vehicle.

8. A system according to claim **1** wherein the record memory is adapted for storing information associated with the image data stored.

9. A system according to claim **1** wherein the interpreter selects images according to analysis criteria so that only the selected images are input to the comparator for comparison to reference images.

10. A system according to claim **9** wherein the selected images represent only portions of a larger image.

11. A monitoring system comprising:

a movably mounted camera adapted for receiving images of a space to be monitored;

an interpreter for receiving image data from the camera; a reference memory for storing reference image data for plural images and a comparator adapted for comparing image data from the interpreter to image data for the plural images from the reference memory according to selected comparison criteria, wherein the interpreter and comparator cooperate to select recognizable portions of image data among unrecognized portions of image data in the space being monitored, the selected image portions being compared to the image data in the reference memory; and

an output interface for reporting results of the image data comparisons performed by the comparator.

12. A method of monitoring a space comprising the steps of:

receiving a first set of image data from the space representing plural images;

identifying and selecting a portion of the information to be stored according to analysis and learn criteria;

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storing the selected information; receiving a second set of image data from the space; identifying and selecting a portion of the second set of image data to be analyzed according to the analysis criteria, wherein the selected portion represents a recognizable portion of image data among unrecognized portions of image data in the space being monitored; comparing the selected portions of the sets of image data to each other so as to compare the second set of image data to the plural images of the first set and determine a correlation of the images; and indicating whether the correlation of the images meets selected comparison criteria.

13. A method according to claim **12** further comprising the step of reporting results of the comparison step according to utilization criteria and augmenting the reporting with identifying information.

14. A method according to claim **12** further comprising the step of establishing the analysis and learn criteria.

15. A method according to claim **12** further comprising the step of establishing the comparison criteria.

16. A method according to claim **12** wherein the image data are sequentially received from different spaces.

17. A method according to claim **12** wherein the step of storing data includes establishing baseline image data and subsequently storing changes from the baseline data.

18. A method according to claim **12** wherein the portions of data selected represent a zone of the space.

19. A method according to claim **18** wherein the steps are repeated for selected data representing a different zone of the space and at least one set of the analysis, learn, and comparison criteria is different from the previous criteria.

20. A method according to claim **12** wherein the comparison of image data is repeated to distinguish between movements based on a series of sequential images.

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PATENT APPLICATION SERIAL NO. _____

U.S. DEPARTMENT OF COMMERCE
PATENT AND TRADEMARK OFFICE
FEE RECORD SHEET

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ABSTRACT OF THE DISCLOSURE

2 A video image of a space is monitored and compared to a
3 reference image. Correlation of the images indicates presence
4 of unwanted persons or objects or the occurrence of unwanted
5 events. When programmed comparison criteria are met, an alarm
6 is activated, the space is displayed on a monitor, and the
7 image is stored in memory. Reference images are stored during
8 dedicated or ongoing learn modes.

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FACILITY MONITORING SYSTEM WITH
IMAGE MEMORY AND CORRELATION

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BACKGROUND OF THE INVENTION

4

1. Field of the Invention

5 This invention relates generally to the field of
6 monitoring and security and specifically to a system that
7 records images and identifies correlation or lack of
8 correlation with the images.

9

2. Description of the Related Art

10 Video cameras are used for monitoring activity in myriad
11 locations and applications. Commonly, a person views a
12 display showing a scene viewed by the cameras. A single
13 display might receive input from several cameras or each
14 camera might have a dedicated display. Frequently, the person
15 is responsible for monitoring several displays, in addition
16 to other responsibilities. The person cannot give undivided
17 attention to each monitor. Even if the person is responsible
18 only for monitoring a single display, fatigue, boredom,
19 hypnosis, or other factors can cause the person to miss events
20 shown on the display.

21 Events recorded by the cameras are frequently stored on
22 tape or by some other memory device for subsequent review.
23 This permits replay and careful review, but monitoring is not

1 automatic and not coincident with the events being recorded.
2 Machine vision devices employing digital image processing
3 are used in manufacturing to test proper positioning, assembly
4 and construction of parts and components. Numerous images of
5 parts or assemblies are successively compared to reference
6 images. Correlation and other characteristics of the
7 comparisons are determined. If a part or assembly does not
8 meet selected criteria, it is determined to be defective and
9 is removed from the manufacturing operation. Examples of such
10 devices and associated systems are shown in U.S. Patents Nos.
11 4,185,298; 4,704,694; 4,728,195; 4,972,359; 5,293,428;
12 5,367,439; 5,371,690; 5,426,509.

13 SUMMARY OF THE INVENTION

14 The present invention provides a monitoring system having
15 a camera adapted for receiving images of a space to be
16 monitored. An interpreter receives image data from the
17 camera, and a reference memory stores reference image data.
18 A comparator is connected for comparing image data from the
19 interpreter to image data from the reference memory according
20 to selected comparison criteria. An output interface reports
21 results of the image data comparisons performed by the
22 comparator.

23 A programmer is provided for inputting the comparison
24 criteria to the comparator. The programmer is connected for
25 inputting analysis criteria to the interpreter and the
26 interpreter is adapted for analyzing the image data according

1 to the analysis criteria. The programmer is connected for
2 inputting learn criteria to the interpreter and the
3 interpreter is connected for storing image data from the
4 camera in the reference memory according to the learn and
5 analysis criteria. The programmer is connected for inputting
6 learn criteria to the interpreter and the interpreter is
7 connected for storing image data from the camera in the
8 reference memory according to the learn criteria. The
9 programmer is connected for inputting utilization criteria,
10 the output interface being adapted for reporting selected
11 comparison results according the utilization criteria.

12 A record memory is connected for storing image data from
13 the output interface. The record memory is adapted for
14 storing information associated with the image data stored.
15 A video monitor is provided for displaying images from the
16 output interface. A second camera is connected to provide
17 image data to the interpreter, wherein the interpreter derives
18 a three-dimensional image of the space and the reference
19 memory, comparator, and output interface are adapted for
20 processing three-dimensional image data.

21 The interpreter is adapted for storing in the reference
22 memory image data from the camera. The interpreter is adapted
23 for periodically storing in the reference memory image data
24 from the camera according to learn criteria. The reference
25 memory is adapted for storing image data for plural images and
26 the comparator is adapted for comparing image data from the
27 interpreter to image data for the plural images from the
28 reference memory according to selected comparison criteria.

1 The camera is mounted to a movable support, such as a vehicle,
2 and the space to be monitored changes according to movement
3 of the support. Alternatively, the camera is mounted to a
4 stationary support. The interpreter is adapted for dividing
5 image data into zones and the comparator is adapted for
6 comparing image data corresponding to the different zones with
7 image data from the reference memory according to different
8 comparison criteria for each zone. The interpreter is adapted
9 for disregarding image data corresponding with a certain zone
10 selected according to selected analysis criteria. The
11 comparator is adapted for sequentially comparing the image
12 data from the different zones and discontinuing comparison of
13 an image upon failure to meet the comparison criteria for the
14 zone being compared. The interpreter is adapted for dividing
15 image data into zones and different criteria are applied to
16 different zones of the image data.

17 The invention also provides a method of monitoring a
18 space. Method steps include receiving a first set of image
19 data from the space; identifying and selecting a portion of
20 the information to be stored according to analysis and learn
21 criteria; storing the selected information; receiving a second
22 set of image data from the space; identifying and selecting
23 a portion of the second set of image data to be analyzed
24 according to the analysis criteria; comparing the selected
25 portions of the sets of image data to each other so as to
26 determine a correlation of the images; and indicating whether
27 the correlation of the images meets selected comparison
28 criteria.

1 Additional steps include reporting results of the
2 comparison step according to utilization criteria;
3 establishing the analysis and learn criteria; establishing the
4 comparison criteria; and establishing the utilization
5 criteria. The step of indicating includes recording image
6 data according to utilization criteria. Plural sets of image
7 data are stored and the step of comparing the image data
8 comprises comparison of the plural sets of image data to one
9 of the sets of image data. The image data are sequentially
10 received from different spaces. The step of storing data
11 includes establishing baseline image data and subsequently
12 storing changes from the baseline data. The portions of data
13 selected represent a zone of the space. The steps are
14 repeated for selected data representing a different zone of
15 the space and at least one set of the analysis, learn, and
16 comparison criteria is different from the previous criteria.

17 The system according to the invention has application in
18 numerous situations where video or human monitoring is
19 presently utilized. In addition, this system has application
20 where video and other forms of monitoring have been
21 ineffective. For example, casinos can use this system for
22 identifying irregularities in the dealing and playing of cards
23 and other games. Commercial facilities can use the system for
24 reliably identifying breaches of security with minimal false
25 alarms. Law enforcement officials can use the system to
26 monitor license plates with mobile or stationary equipment for
27 identifying stolen vehicles.

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BRIEF DESCRIPTION OF THE DRAWINGS

2 Fig. 1 shows a block diagram of a monitoring system
3 according to the invention; and

4 Fig. 2 shows a schematic diagram of another embodiment
5 of the invention.

6

DESCRIPTION OF THE PREFERRED EMBODIMENTS

7 Referring to Fig. 1, a monitoring system 10 includes
8 cameras 12, 13 for monitoring a space 14. The space 14 can
9 be a room, an entry, a passage, or any other location. The
10 cameras 12, 13 are mounted on stationary supports, such as
11 walls of the space 14. In one embodiment, the camera 12 is
12 a digital video camera translating visible images into digital
13 electric signals. As discussed below, other cameras are also
14 suitable, such as analog or infrared. A single camera can be
15 used for two dimensional images; Two cameras are used for
16 three-dimensional images, wherein an interpreter derives the
17 three-dimensional image from image data received from the two
18 cameras. Additional cameras can be used for monitoring
19 different spaces or different characteristics of the same
20 space. The cameras are connected to input image data to an
21 interpreter 16. The interpreter 16 selects image data from
22 the cameras 12, 13 according to analysis criteria input from
23 a programmer 18. Programming can be performed directly by
24 user inputs provided at the programmer or remotely, for
25 example by a modem using a computer with a program interface.

1 A reference memory 20 receives data from the interpreter 16
2 according to storage criteria input to the interpreter by the
3 programmer 18. A comparator 22 receives data from the
4 interpreter 16 and reference memory 20 and compares these data
5 according to comparison criteria input by the programmer 18.
6 The comparator 22 determines a correlation between pixels from
7 the reference memory 20 and pixels from the interpreter 16.
8 If the comparator 22 determines that the correlation falls
9 within or outside of a selected range requiring action,
10 results of the comparison are input to an output interface 24,
11 such as an alarm panel, a memory interface, or a video monitor
12 interface. The output interface 24 reports results of the
13 comparison by selecting comparison data to be stored or
14 otherwise utilized by a record memory 26 or monitor 28, for
15 example, connected to receive data from the output interface
16 according to criteria input by the programmer 18. Preferably,
17 the interpreter 16, programmer 18, reference memory 20,
18 comparator 22, and output interface 24 are integrated in a
19 microcomputer and associated software.

20 Using the programmer 18, a user inputs learn criteria,
21 including analysis and storage criteria for reference images
22 to be stored in the reference memory. For example, the user
23 can instruct the interpreter 16 to identify and store in the
24 reference memory 20 a pixel representation of all stationary
25 objects on a shelf in the space 14 at a selected time. The
26 interpreter 16 identifies the object images meeting the
27 programmed criteria, and stores the images in the reference
28 memory 20. The reference memory can be divided into sections

1 for storing different types of data. The reference memory can
2 include an archive section in which baseline image data are
3 stored. After storing the baseline data, subsequent images
4 can be stored by storing only data that have changed from the
5 baseline. According to user programming, the storing of
6 images can be repeated at selected times or continuously
7 according to the learn criteria. For example, the stationary
8 objects can be identified at the same time every day, or when
9 a person whose image data is in the reference memory appears
10 in the space with a new person, the new person's image data
11 is stored in the reference memory. Also, the learn criteria
12 can be automatically revised to create new learn criteria
13 according to image data from the interpreter and the current
14 learn criteria.

15 The user also programs analysis criteria for monitoring
16 the space. For example, the interpreter 16 can monitor image
17 data from the camera 12 during certain time periods when the
18 images of the stationary objects are not supposed to be moved.

19 The user also inputs comparison criteria. Comparison
20 criteria include selecting the images to be compared and a
21 range of correlation in which the monitored image is
22 sufficiently like the reference image for a particular
23 purpose. For example, stationary object images and monitored
24 images are compared to determine whether any object previously
25 identified as stationary is not in its previous location.
26 Image data from the interpreter and the reference memory are
27 compared by the comparator 22 according to the comparison
28 criteria to determine correlation of the images. For example,

1 if the location of an object in the image data from the
2 interpreter is not the same as the location of the same object
3 in the reference memory, then the comparator sends an alarm
4 signal to the output interface 24 indicating an alarm
5 condition. Sensitivity of the correlation can be adjusted.
6 For example, the alarm condition can occur on any movement of
7 an object or only on complete absence of an object from the
8 space. The comparison criteria can include events or
9 movements as well as stationary patterns. For example, a
10 person's hand would be an acceptable stationary pattern, but
11 a pixel pattern representing sudden movement of the hand, such
12 as striking something, would represent an impermissible event
13 causing an alarm. The alarm signal can include an image of
14 the space, an identification of the space or the object, the
15 time of the signal, or any other signal indicating that the
16 comparison criteria have been met or not met, as is
17 appropriate. The output interface 24 selects and/or
18 translates the appropriate signals and forwards them to output
19 devices. For example, an audible alarm sounds and the monitor
20 28 shows the video image of the space 14 when the object is
21 moved, and the image, date and time of the movement of the
22 object is recorded in the record memory 26. Multiple
23 monitoring system components can be connected to a single
24 output interface and monitor to monitor different spaces or
25 different parts of a space. When an alarm condition arises
26 in one space, its output is sent to the monitor and can be
27 augmented by other information such as sound from the space
28 being monitored and information about the space or condition.

1 Learning and analysis can be performed separately or
2 coincidentally. Learning can be accomplished directly by
3 entering a learn only mode and recording images in the
4 reference memory. Learning can also be accomplished
5 indirectly, for example by association of new images with
6 previously learned images or by receiving new images during
7 permitted learning periods that coincide with monitoring
8 periods.

9 Referring to Fig. 2, the camera 12 can be mounted on a
10 mobile support, such as a vehicle 30. The space 14 and
11 objects 32 being monitored change according to movement of the
12 vehicle 30. For example, the camera can be mounted on a
13 police car and programmed to monitor license plate numbers.
14 The reference memory stores license numbers for stolen cars.
15 Analysis is limited to consistently sized characters within
16 a specified boundary, that is the rectangular shape of the
17 license plate. When the object 32 meets the analysis criteria
18 of a license plate, the number is compared to the numbers in
19 the reference memory. When the comparison finds a match, an
20 appropriate alarm indicates discovery of a stolen car to
21 officers in the police car. Information about the car and
22 possible occupants can be displayed as well.

23 The invention, as shown for example in Figs. 1 and 2, can
24 be used in numerous methods of operation. The license plate
25 example utilizes a high degree of correlation between the
26 reference image and the monitored image. Other aspects of the
27 invention, discussed previously and below, utilize lack of
28 correlation between the reference and monitored images to

1 trigger an alarm condition. Combinations of these aspects can
2 also be used for different objects or spaces monitored by the
3 same system.

4 A limited access entry or passage, an office or
5 workspace, or a home can be monitored. The learn criteria
6 identify persons permitted to be in the monitored space, image
7 data of their faces being stored in the reference memory. The
8 space monitored is generally consistent so that the analysis
9 criteria ignore the environment and limit the analysis to the
10 faces of persons in the space. The comparison criteria are
11 set to identify unauthorized persons in the space according
12 to comparison of persons in the space with persons in the
13 reference memory. The comparison allows for variations in
14 appearance, such as changes in hair style or facial
15 expressions, by allowing pixel comparisons to vary within a
16 range and by focusing on less changeable parts, such as the
17 nose.

18 Sensitivity of the correlation can be varied within a
19 space being monitored. Image data for a space can be divided
20 into zones in which different learn, analysis, comparison,
21 and/or utilization criteria apply. For example, monitoring
22 roads to locate license plates, as described with reference
23 to Fig. 2, can also include monitoring the object vehicles 34.
24 License plate characters are uniform, so close correlation of
25 the reference and object in zone A is desired. The color and
26 general outline of the object vehicle can also be analyzed,
27 however, lesser correlation is desired in zone B because
28 different lighting can affect color and the amount of data

1 required for the comparison can be limited. Also, assuming
2 the license plate characters match, close correlation of the
3 vehicle comparison may not be necessary. An alternative
4 analysis and comparison would identify a license plate match
5 in zone A and then compare the vehicle outline in zone B. If
6 the vehicle outline does not sufficiently correlate with the
7 image data corresponding to the license plate number, the
8 output interface would report that the license plate has been
9 switched from the vehicle on which the plate is supposed to
10 be mounted.

11 Images from different zones can be compared sequentially.
12 The results of a comparison in one zone can affect whether and
13 how a subsequent comparison is performed. For example, the
14 results of a comparison in one zone can determine which zone
15 and/or what comparison criteria are used for a subsequent
16 comparison.

17 Another method monitors a consistent space, with many
18 different objects and persons. The analysis is limited to
19 specifically defined movements or events possibly within a
20 specified zone. For example, cheating at a casino black jack
21 table is monitored by identifying cards that move outside a
22 selected zone on the table. Also, a person's hand or arm that
23 reaches from the players' side of the table into a forbidden
24 zone will trigger an alarm. However, the dealer's arms and
25 the movement of cards in the playing zone are ignored. Events
26 occurring away from the table are also ignored although they
27 might be recorded for the purpose of identifying the offending
28 player.

1 In some applications, all but very specific events can
2 be ignored. For example, bank employees can be trained to
3 make a certain movement during a robbery. To the uninitiated,
4 the signal appears innocuous, but the monitoring system is
5 programmed to recognize the movement and trigger an alarm.
6 Like a password, the movement can be changed and accordingly
7 reprogrammed in the system.

8 Data other than visual images can also be analyzed. For
9 example, thermal images can be used to sense overheating of
10 equipment or fires in facilities. Micropower impulse radar
11 (MIR) can be used to monitor spaces through smoke, walls, or
12 other opaque materials. Different types of cameras or cameras
13 collecting different types of image data can be combined. For
14 example, a thermal camera can monitor a space to sense a fire.
15 A radar camera can monitor the same space to sense whether
16 floors or walls have collapsed due to the fire.

17 Monitoring can be accomplished in real time or using
18 images collected previously. For example, an amusement park
19 can use cameras located at different points in the park.
20 Analysis of traffic flow can be analyzed in real time based
21 on criteria selected prior to monitoring. Results can be used
22 immediately to correct for unwanted conditions.
23 Alternatively, the cameras can collect image data for storage.
24 At a later time, comparison can be made based on criteria
25 selected at the later time and the comparison results used to
26 establish a statistical database for future planning.

27 The present disclosure describes several embodiments of
28 the invention, however, the invention is not limited to these

1 embodiments. Other variations are contemplated to be within
2 the spirit and scope of the invention and appended claims.

CLAIMS

WHAT IS CLAIMED IS:

1 Sub B. 1. A monitoring system comprising:
2 [movably mounted](#)
3 a camera adapted for receiving images of a space to
4 be monitored;
5 an interpreter for receiving image data from the
6 camera;
7 a reference memory for storing reference image data;
8 a comparator connected for comparing image data from
9 the interpreter to image data from the reference memory
10 according to selected comparison criteria; and
11 an output interface for reporting results of the
12 image data comparisons performed by the comparator.

1 2. A system according to claim 1 further comprising a
2 programmer for inputting the comparison criteria to the
3 comparator.

1 3. A system according to claim 2 wherein the programmer
2 is connected for inputting analysis criteria to the
3 interpreter and the interpreter is adapted for analyzing the
4 image data according to the analysis criteria.

1 4. A system according to claim 3 wherein the programmer
2 is connected for inputting learn criteria to the interpreter
3 and the interpreter is connected for storing image data from

4 the camera in the reference memory according to the learn and
5 analysis criteria.

1 5. A system according to claim 2 wherein the programmer
2 is connected for inputting learn criteria to the interpreter
3 and the interpreter is connected for storing image data from
4 the camera in the reference memory according to the learn
5 criteria.

1 6. A system according to claim 2 wherein the programmer
2 is connected for inputting utilization criteria, the output
3 interface being adapted for reporting selected comparison
4 results according the utilization criteria.

1 7. A system according to claim 1 wherein the camera is
2 movably mounted.

1 8. A system according to claim 7 wherein the camera is
2 mounted on a vehicle.

1 9. A system according to claim 1 further comprising a
2 record memory connected for storing image data from the output
3 interface.

B 10. A system according to claim 9 wherein the record
2 memory is adapted for storing information associated with the
3 image data stored.

1 11. A system according to claim 1 further comprising a
2 video monitor for displaying images from the output interface.

1 12. A system according to claim 1 further comprising a
2 second camera connected to provide image data to the
3 interpreter, wherein the interpreter derives a three-
4 dimensional image of the space and the reference memory,
5 comparator, and output interface are adapted for processing
6 three-dimensional image data.

1 13. A monitoring system according to claim 1 wherein the
2 interpreter is adapted for storing in the reference memory
3 image data from the camera.

1 14. A monitoring system according to claim 1 wherein the
2 interpreter is adapted for periodically storing in the
3 reference memory image data from the camera according to learn
4 criteria.

SUBA1

1 15. A monitoring system according to claim 1 wherein the
2 reference memory is adapted for storing image data for plural
3 images and the comparator is adapted for comparing image data
4 from the interpreter to image data for the plural images from
5 the reference memory according to selected comparison
6 criteria.

1 16. A monitoring system according to claim 15 wherein
2 the camera is mounted to a movable support and the space to

3 be monitored changes according to movement of the support.

1 17. A monitoring system according to claim 15 wherein
2 the camera is mounted to a stationary support.

1 18. A monitoring system according to claim 1 wherein the
2 interpreter is adapted for dividing image data into zones and
3 the comparator is adapted for comparing image data
4 corresponding to the different zones with image data from the
5 reference memory according to different comparison criteria
6 for each zone.

1 19. A monitoring system according to claim 18 wherein
2 the interpreter is adapted for disregarding image data
3 corresponding with a certain zone selected according to
4 selected analysis criteria.

1 20. A monitoring system according to claim 18 wherein
2 the comparator is adapted for sequentially comparing the image
3 data from the different zones and discontinuing comparison of
4 an image upon failure to meet the comparison criteria for the
5 zone being compared.

1 21. A monitoring system according to claim 1 wherein the
2 interpreter is adapted for dividing image data into zones and
3 different criteria are applied to different zones of the image
4 data.

SUB A2

22. A method of monitoring a space comprising the steps
of:
receiving a first set of image data from the
space;
identifying and selecting a portion of the
information to be stored according to analysis and learn
criteria;
storing the selected information;
receiving a second set of image data from the
space;
identifying and selecting a portion of the
second set of image data to be analyzed according to the
analysis criteria;
comparing the selected portions of the sets of
image data to each other so as to determine a correlation of
the images; and
indicating whether the correlation of the
images meets selected comparison criteria.

1 23. A method according to claim 22 further comprising
2 the step of reporting results of the comparison step according
3 to utilization criteria.

1 24. A method according to claim 22 wherein the step of
2 indicating includes recording *a* image data according to
3 utilization criteria.

1 14. A method according to claim 22 further comprising

2 the step of establishing the analysis and learn criteria.

1 ^{15.}
1 ~~26.~~ A method according to claim ~~22~~ ¹² further comprising
2 the step of establishing the comparison criteria.

1 ~~27.~~ A method according to claim 22 further comprising
2 the step of establishing the utilization criteria.

1 ^{16.}
1 ~~28.~~ A method according to claim 22 wherein plural sets
2 of image data are stored and the step of comparing the image
3 data comprises comparison of the plural sets of image data to
4 one of the sets of image data.

1 ^{17.}
1 ~~29.~~ A method according to claim ~~22~~ ¹² wherein the image
2 data are sequentially received from different spaces.

1 ^{18.}
1 ~~30.~~ A method according to claim ~~22~~ ¹² wherein the step of
2 storing data includes establishing baseline image data and
3 subsequently storing changes from the baseline data.

1 ^{19.}
1 ~~31.~~ A method according to claim ~~22~~ ¹² wherein the portions
2 of data selected represent a zone of the space.

1 ^{18.}
1 ~~32.~~ A method according to claim ~~31~~ ¹⁸ wherein the steps are
2 repeated for selected data representing a different zone of
3 the space and at least one set of the analysis, learn, and
4 comparison criteria is different from the previous criteria.

DECLARATION AND POWER OF ATTORNEY
(Sole Inventor)

I, John B. Adrain, hereby declare that I am a citizen of the United States of America and a resident of Salt Lake City, Utah; that I have reviewed and understand the content of the attached specification, including the claims (Pearne, Gordon, McCoy & Granger Docket No. 29520), and I believe that I am the original, first, and sole inventor of the subject matter which is claimed therein and for which a patent is sought on the invention or discovery entitled

"FACILITY MONITORING SYSTEM WITH IMAGE MEMORY AND CORRELATION"

and that I acknowledge my duty to disclose information of which I am aware which is material to the examination of this application, in accordance with Title 37, Code of Federal Regulations, Section 1.56.

I hereby designate the following as my mailing address and telephone number:

Pearne, Gordon, McCoy & Granger
1200 Leader Building
Cleveland, Ohio 44114
(216) 579-1700

and appoint each of the following as my attorneys with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected therewith:

Charles B. Gordon, Reg. No. 16923
William C. McCoy, Reg. No. 16885
Richard H. Dickinson, Jr., Reg. No. 18622
Thomas P. Schiller, Reg. No. 20677
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Richard M. Mescher, Reg. No. 38242

I further declare that all statements made herein of my own knowledge are true and that all statements made herein on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the

United States Code, and that such willful false statements may jeopardize the validity of the application or any patent issuing thereon.

100
John B. Adrain

Date 7-4-96

Post Office Address:
Box 299
Salt Lake City, Utah 84110

UT



PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: John B. Adrain

Title: "FACILITY MONITORING SYSTEM WITH IMAGE MEMORY
AND CORRELATION"

Docket No: 29520

VERIFIED STATEMENT CLAIMING SMALL ENTITY STATUS

I hereby declare that I am an independent inventor for purposes of paying reduced fees to the Patent and Trademark Office with regard to the above-entitled invention, described in the specification filed herewith.

I have not assigned, granted, conveyed or licensed, and am under no obligation under contract or law to assign, grant, convey or license, any rights in the invention to any person or to any concern which would not qualify as a small business concern or a non-profit organization.

I acknowledge the duty to file, in this application, notification of any change in status resulting in loss of entitlement to small entity status prior to paying, or at the time of paying, the earliest of the issue fee or any maintenance fee due after the date on which status as a small entity is no longer appropriate.

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code, and that such willful false statements may jeopardize the validity of the application, any patent issuing thereon, or any patent to which this verified statement is directed.

John B. Adrain

Date: 7-4-96



PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: John B. Adrain

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John B. Adrain

Date: 7-4-96



PATENT

THE UNITED STATES PATENT AND TRADEMARK OFFICE

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John B. Adrain

Date: 7-4-96

PRINT OF DRAWINGS
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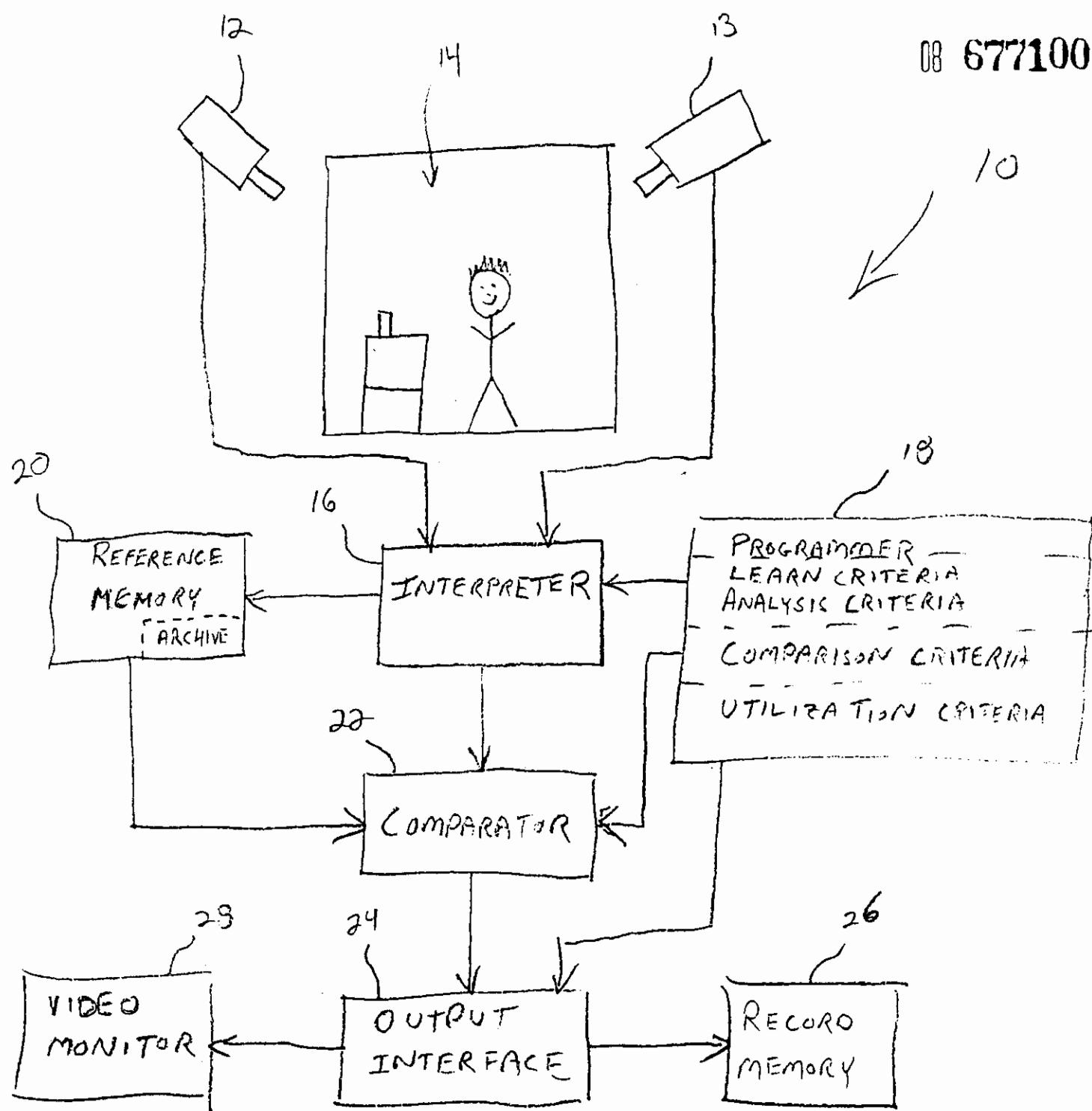


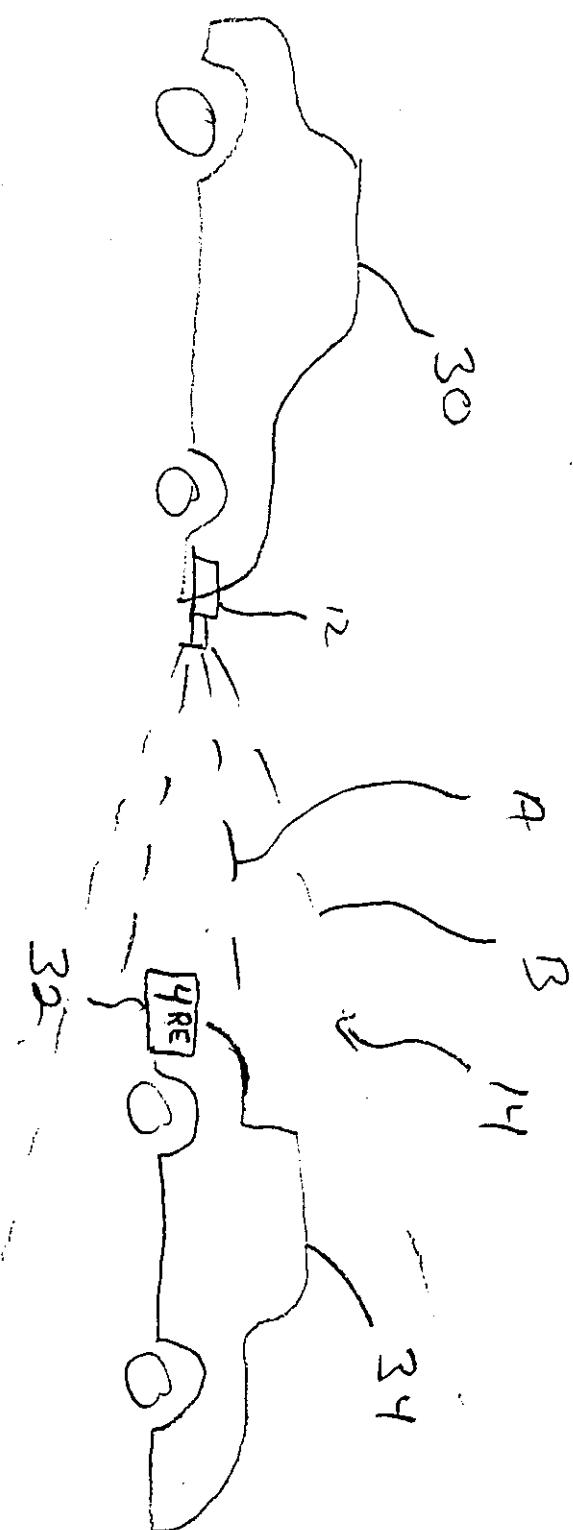
Fig. 1

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FIG. 2



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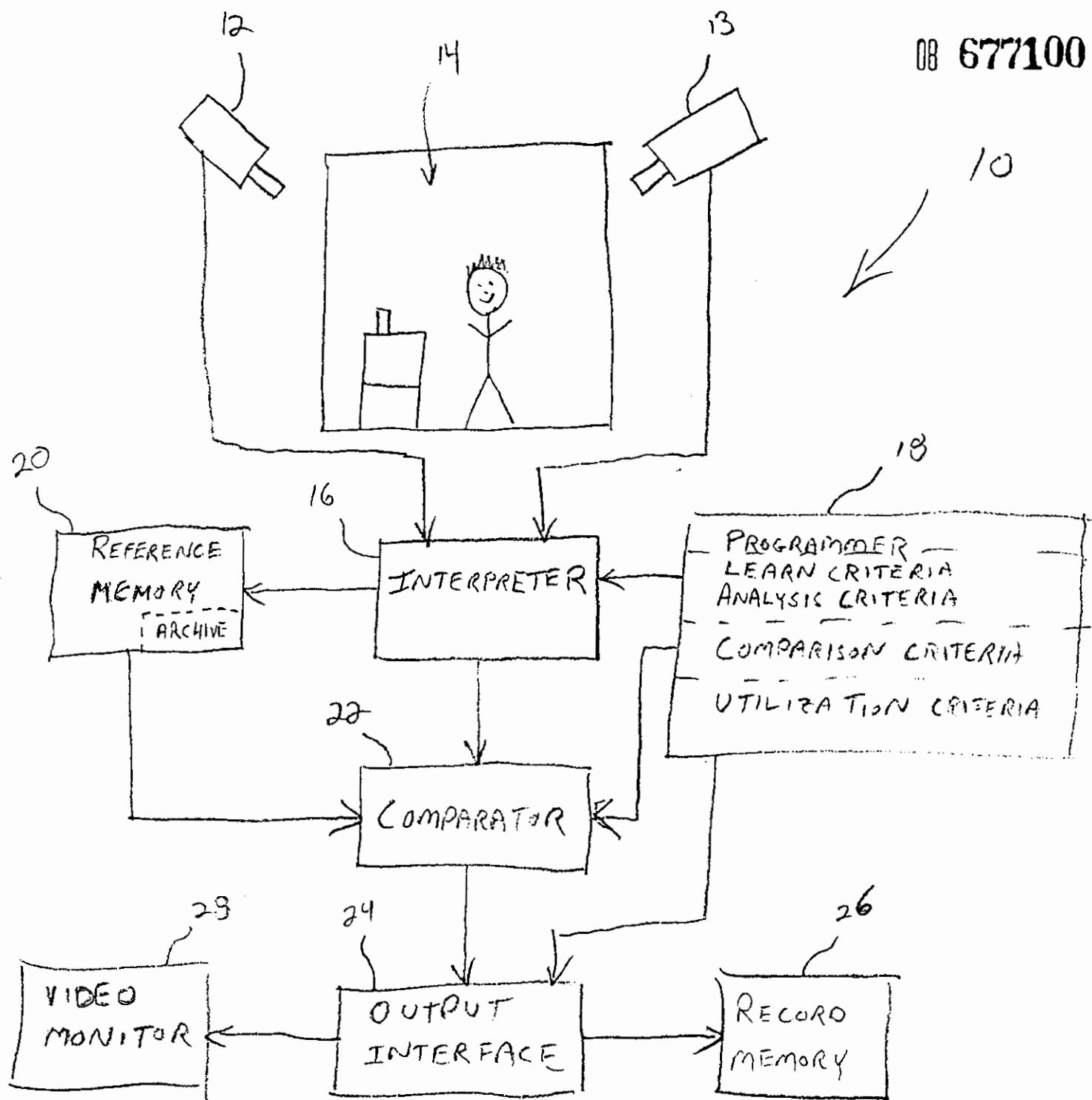
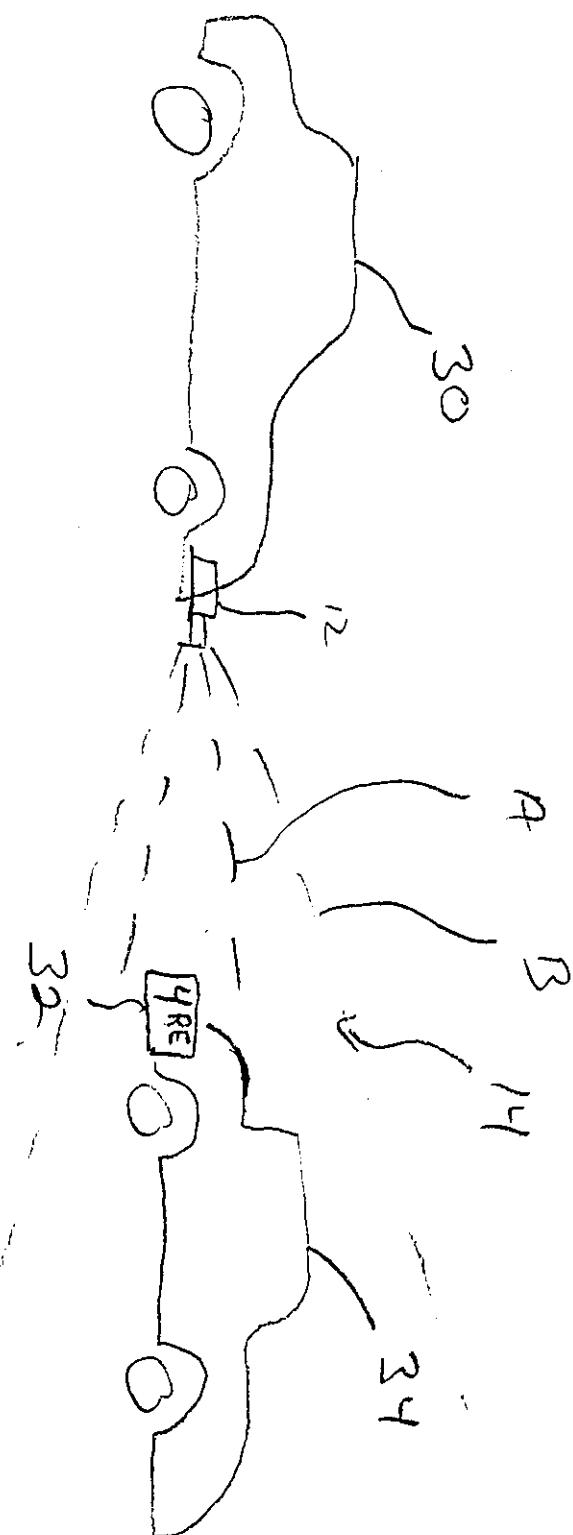


Fig. 1

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FIG. 2



A000052

PATENT APPLICATION FEE DETERMINATION RECORD Effective October 1, 1995					Application or Docket Number <i>677100</i>		
CLAIMS AS FILED - PART I							
(Column 1)		(Column 2)					
FOR	NUMBER FILED	NUMBER EXTRA			SMALL ENTITY	OTHER THAN SMALL ENTITY	
BASIC FEE					RATE	FEES	
TOTAL CLAIMS	<i>32</i> minus 20 =	*	<i>12</i>		x\$11=	<i>132</i>	
INDEPENDENT CLAIMS	<i>2</i> minus 3 =	*			x39=		
MULTIPLE DEPENDENT CLAIM PRESENT					+125=		
* If the difference in column 1 is less than zero, enter "0" in column 2					TOTAL	<i>507</i>	
					OR	TOTAL	
CLAIMS AS AMENDED - PART II							
(Column 1)		(Column 2)			(Column 3)		
AMENDMENT A	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	SMALL ENTITY	OTHER THAN SMALL ENTITY	
	Total	<i>* 31</i>	Minus	<i>** 32</i>	= <i>-</i>	RATE	ADDITIONAL FEE
	Independent	<i>* 2</i>	Minus	<i>*** 2</i>	= <i>-</i>	x\$11=	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					x39=		
					+125=		
					TOTAL ADDIT. FEE		
AMENDMENT B	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	SMALL ENTITY	OTHER THAN SMALL ENTITY	
	Total	<i>* </i>	Minus	<i>** </i>	= <i> </i>	RATE	ADDITIONAL FEE
	Independent	<i>* </i>	Minus	<i>*** </i>	= <i> </i>	x\$11=	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					x39=		
					+125=		
					TOTAL ADDIT. FEE		
AMENDMENT C	CLAIMS REMAINING AFTER AMENDMENT		HIGHEST NUMBER PREVIOUSLY PAID FOR	PRESENT EXTRA	SMALL ENTITY	OTHER THAN SMALL ENTITY	
	Total	<i>* </i>	Minus	<i>** </i>	= <i> </i>	RATE	ADDITIONAL FEE
	Independent	<i>* </i>	Minus	<i>*** </i>	= <i> </i>	x\$11=	
FIRST PRESENTATION OF MULTIPLE DEPENDENT CLAIM					x39=		
					+125=		
					TOTAL ADDIT. FEE		
* If the entry in column 1 is less than the entry in column 2, write "0" in column 3. ** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 20, enter "20." *** If the "Highest Number Previously Paid For" IN THIS SPACE is less than 3, enter "3." The "Highest Number Previously Paid For" (Total or Independent) is the highest number found in the appropriate box in column 1.					OR	TOTAL ADDIT. FEE	

Form PTO 1130
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PACE DATA ENTRY CODING SHEET

U.S. DEPARTMENT OF COMMERCE		
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1ST EXAMINER	<i>Autu</i>	DATE <u>9/19/96</u>
2ND EXAMINER		DATE

APPLICATION NUMBER		TYPE APPL		FILING DATE			SPECIAL HANDLING		GROUP ART UNIT		CLASS		SHEETS OF DRAWING									
08 677100		<input type="checkbox"/> I		0	7	0	9	9	6			<input type="checkbox"/> D	2	6	1	5	<input type="checkbox"/> 3	5	8	<input type="checkbox"/> -	<input type="checkbox"/> -	<input type="checkbox"/> 2

CONTINUITY DATA

PCT/FOREIGN APPLICATION DATA

BAR CODE LABEL		U.S. PATENT APPLICATION			
		FILING DATE	CLASS	GROUP ART UNIT	
SERIAL NUMBER 08/677,100		07/09/96	358	2615	
APPLICANT	JOHN B. ADRAIN, SALT LAKE CITY, UT.				
<p>**CONTINUING DATA***** VERIFIED</p> <hr/> <p>**FOREIGN/PCT APPLICATIONS***** VERIFIED</p> <hr/>					
FOREIGN FILING LICENSE GRANTED 08/20/96				***** SMALL ENTITY *****	
STATE OR COUNTRY UT	SHEETS DRAWING 2	TOTAL CLAIMS 32	INDEPENDENT CLAIMS 2	FILING FEE RECEIVED \$507.00	ATTORNEY DOCKET NO. 29520
ADDRESS TITLE	PEARNE GORDON MCCOY & GRANGER 1200 LEADER BLDG CLEVELAND OH 44114 FACILITY MONITORING SYSTEM WITH IMAGE MEMORY AND CORRELATION				
<p>This is to certify that annexed hereto is a true copy from the records of the United States Patent and Trademark Office of the application which is identified above.</p> <p>By authority of the COMMISSIONER OF PATENTS AND TRADEMARKS</p>					
Date	Certifying Officer				

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#2

PATENT



PEARNE, GORDON, McCOY & GRANGER
1200 Leader Building
Cleveland Ohio 44114-1401
(216) 579-1700

Attorney Docket No. 29520

Assistant Commissioner for Patents
Box PATENT APPLICATION
Washington, D.C. 20231

Sir:

Transmitted herewith for filing by a small entity is the patent application of:

Inventor: John B. Adrain

For: "FACILITY MONITORING SYSTEM WITH
IMAGE MEMORY AND CORRELATION"

A Small Entity Declaration and two photocopies thereof are enclosed.

Two sheets of informal drawings are included.

Copies of references cited in the specification are enclosed, along with PTO Form 1449.

"Express Mail" mailing label number TB442952455US

Date of Deposit July 9, 1996

I hereby certify that this paper or fee is being deposited with the United States Postal Service "Express Mail Post Office to Addressee" service under 37 C.F.R. § 1.10 on the date indicated above and is addressed to the Assistant Commissioner for Patents, Washington, D.C. 20231.

Mary Ann Patsko

Printed Name of Person Mailing Paper or Fee

Mary Ann Patsko

Signature of Person Mailing Paper or Fee

CLAIMS AS FILED

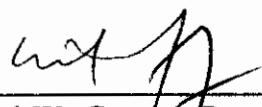
<u>For</u>	<u>Number</u>	<u>Rate</u>	<u>Fees</u>
Total claims in excess of 20:	12	x \$11.00	\$132.00
Independent claims in excess of 3:	0	x \$39.00	\$0.00
Multiple dependent claims, if any, add surcharge of \$125.00:			\$0.00
Non English Specification, add surcharge of \$130.00:			\$0.00
		Basic Fee	\$375.00
		TOTAL FILING FEE	<u>\$507.00</u>
Assignment Recordal Fee of \$40.00			\$0.00
		<u>TOTAL FEE</u>	<u>\$507.00</u>

A check in the amount of the Total Fee calculated above is enclosed.

The Commissioner is hereby authorized to charge any fees under 37 C.F.R. §§1.16 and 1.17 which may be required during the entire pendency of this application, or to credit any overpayment, to Deposit Account No. 16-0820, Order No. 29520.

Respectfully,

PEARNE, GORDON, McCOY & GRANGER

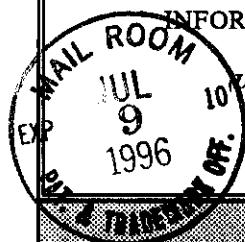


Michael W. Garvey, Reg. No. 35878

Date: 9 July 96

Form PTO-1449	U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE	ATTY. DOCKET NO. 29520	SERIAL NO.
INFORMATION DISCLOSURE CITATION BY APPLICANT <small>USE SEVERAL SHEETS IF NECESSARY</small>		APPLICANT: John B. Adrain	
		FILING DATE:	GROUP ART UNIT:

#2
M. H. 10-31-96

**U.S. PATENT DOCUMENTS**

Examiner Initial		Document No.	Date	Name	Class	Subclass	Filing Date If Appropriate
<i>J</i>	A	4,185,298	01/1980	Billet et al			
<i>J</i>	B	4,547,897	10/1985	Peterson			
<i>J</i>	C	4,704,694	11/1987	Czerniejewski			
<i>J</i>	D	4,728,195	03/1988	Silver			
<i>J</i>	E	4,972,359	11/1990	Silver et al			
<i>J</i>	F	5,293,428	03/1994	Kondou et al			
<i>J</i>	G	5,367,439	11/1994	Mayer et al			
<i>J</i>	H	5,371,690	12/1994	Engel et al			
<i>J</i>	I	5,426,509	06/1995	Peplinski			
	J						
	K						

FOREIGN PATENT DOCUMENTS

		Document No.	Date	Country	Class	Subclass	Translation
	L						
	M						
	N						
	O						
	P						

OTHER REFERENCES (Including Author, Title, Date, Pertinent Pages, Etc.)

	Q	
	R	
	S	

Examiner:	<i>FRANK SNOW</i>	Date Considered
*Examiner:	Initial if reference considered, regardless of whether citation is in conformance with MPEP 609; Draw line through citation if not in conformance and not considered. Include copy of this form with next communication to applicant.	



**UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office**

Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

SERIAL NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NO.
10/10/2008	10/10/2008	John Doe	

EXAMINER

ART UNIT	PAPER NUMBER
3	

DATE MAILED:

10/10/2008

Please find below a communication from the EXAMINER in charge of this application.

Commissioner of Patents

Office Action Summary	Application No. 08/677,100	Applicant(s) Adrain
	Examiner Frank Snow	Group Art Unit 2615
		
<p><input checked="" type="checkbox"/> Responsive to communication(s) filed on <u>Jul 9, 1996</u></p> <p><input type="checkbox"/> This action is FINAL.</p> <p><input type="checkbox"/> Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under <i>Ex parte Quayle</i>, 1935 C.D. 11; 453 O.G. 213.</p> <p>A shortened statutory period for response to this action is set to expire <u>3</u> month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).</p>		
<p>Disposition of Claims</p> <p><input checked="" type="checkbox"/> Claim(s) <u>1-32</u> is/are pending in the application.</p> <p>Of the above, claim(s) _____ is/are withdrawn from consideration.</p> <p><input type="checkbox"/> Claim(s) _____ is/are allowed.</p> <p><input checked="" type="checkbox"/> Claim(s) <u>1-32</u> is/are rejected.</p> <p><input type="checkbox"/> Claim(s) _____ is/are objected to.</p> <p><input type="checkbox"/> Claims _____ are subject to restriction or election requirement.</p>		
<p>Application Papers</p> <p><input checked="" type="checkbox"/> See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.</p> <p><input type="checkbox"/> The drawing(s) filed on _____ is/are objected to by the Examiner.</p> <p><input type="checkbox"/> The proposed drawing correction, filed on _____ is <input type="checkbox"/> approved <input type="checkbox"/> disapproved.</p> <p><input type="checkbox"/> The specification is objected to by the Examiner.</p> <p><input type="checkbox"/> The oath or declaration is objected to by the Examiner.</p>		
<p>Priority under 35 U.S.C. § 119</p> <p><input type="checkbox"/> Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).</p> <p><input type="checkbox"/> All <input type="checkbox"/> Some* <input type="checkbox"/> None of the CERTIFIED copies of the priority documents have been received.</p> <p><input type="checkbox"/> received in Application No. (Series Code/Serial Number) _____.</p> <p><input type="checkbox"/> received in this national stage application from the International Bureau (PCT Rule 17.2(a)).</p> <p>*Certified copies not received: _____</p> <p><input type="checkbox"/> Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).</p>		
<p>Attachment(s)</p> <p><input checked="" type="checkbox"/> Notice of References Cited, PTO-892</p> <p><input checked="" type="checkbox"/> Information Disclosure Statement(s), PTO-1449, Paper No(s). <u>2</u></p> <p><input type="checkbox"/> Interview Summary, PTO-413</p> <p><input checked="" type="checkbox"/> Notice of Draftsperson's Patent Drawing Review, PTO-948</p> <p><input type="checkbox"/> Notice of Informal Patent Application, PTO-152</p>		
<p>--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---</p>		

Serial Number: 08/677100

-2-

Art Unit: 2615

Part III DETAILED ACTION

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. § 103 which forms the basis for all obviousness rejections set forth in this Office action:

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Subject matter developed by another person, which qualifies as prior art only under subsection (f) or (g) of section 102 of this title, shall not preclude patentability under this section where the subject matter and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

1. Claims 1-32 are rejected under 35 U.S.C. § 103 as being unpatentable over Pomerleau (5,091,780) in view of Sadovnik et al. (5,497,430), Coutta (4,337,482), Urquhart (4,514,068) and Araki et al. (4,737,847).

2. Pomerleau discloses substantially the same system and method for a monitoring system including a camera adapted for receiving images of a space to be monitored (Figs. 1 and 2; and Col. 3, lines 61-63); and a reference memory for storing reference image data (Fig. 1 [30] and Fig. 2 [30, 34, 36]); and a comparator for

Serial Number: 08/677100

-3-

Art Unit: 2615

comparing image data from the interpreter to image data from the reference memory, according to selected comparison criteria (Fig. 2, [38]); and an output interface for reporting results of the image data comparisons performed by the comparator (Fig. 2, [22]), as specified in Claims 1 and 22; and further comprising a programmer for inputting the comparison criteria to the analysis criteria (Figs. 1 and 2; Col. 3, lines 29-40 and 64-68), as specified in Claims 2 and 26; and wherein the programmer is connected for inputting utilization criteria, the output interface being adapted for reporting selected comparison results according to the utilization criteria (Col. 5, lines 3-17), as specified in Claims 6, 23 and 27; and further comprising a record memory connected for storing image data from the output interface (Col. 5, lines 65-68), as specified in Claims 9 and 24; and wherein the record memory is adapted for storing information associated with the image stored data (Col. 6, lines 1-9), as specified in Claim 10; and further comprising a video monitor for displaying images from the output interface (Col. 6, lines 44-46), as specified in Claim 11; and wherein the interpreter is adapted for storing in the reference memory, the image data from the camera (Col. 4, lines 58-62), as specified in Claim 13; and wherein the interpreter is adapted for periodically storing in the reference memory, image data from the camera according to learn criteria (Col. 4, lines 62-67), as specified in Claims 14

Serial Number: 08/677100

-4-

Art Unit: 2615

and 30; and wherein the reference memory is adapted for storing image data for plural images, and the comparator is adapted for comparing image data from the interpreter to image data for the plural images from the reference memory according to selected comparison criteria (Col. 4, lines 24-29), as specified in Claims 15 and 28.

Pomerleau does not particularly disclose details of an interpreter for receiving image data from a camera, including an interpreter for receiving image data from the camera, as specified in Claims 1 and 22; and wherein the programmer is connected for inputting analysis criteria to the interpreter and the interpreter is adapted for analyzing the image data according to the analysis criteria, as specified in Claims 3 and 25; and wherein the programmer is connected for inputting learn criteria to the interpreter, and the interpreter is connected for storing image data from the camera in the reference memory according to the learn and analysis criteria, as specified in Claims 4 and 25; and wherein the programmer is connected for inputting learn criteria to the interpreter, and the interpreter is connected for storing image data from the camera in the reference memory according to the learn criteria, as specified in Claims 5 and 25; and further comprising a second camera connected to provide image data to the interpreter, wherein the interpreter derives a three-

Serial Number: 08/677100

-5-

Art Unit: 2615

dimensional image of the space, and the reference memory, comparator, and output interface are adapted for processing three-dimensional image data, as specified in Claim 12.

Sadovnik et al. teach the well known details of an interpreter for receiving image data from a camera (Col. 3, lines 10-44), including an interpreter for receiving image data from the camera (Col. 5, lines 51-67 and Col. 6, lines 26; as specified in Claims 1 and 22; and wherein the programmer is connected for inputting analysis criteria to the interpreter and the interpreter is adapted for analyzing the image data according to the analysis criteria (Col. 3, lines 10-44), as specified in Claims 3 and 25; and wherein the programmer is connected for inputting learn criteria to the interpreter, and the interpreter is connected for storing image data from the camera in the reference memory according to the learn and analysis criteria (Col. 3, lines 45-67 and Col. 4, lines 1-12, as specified in Claims 4 and 25; and wherein the programmer is connected for inputting learn criteria to the interpreter, and the interpreter is connected for storing image data from the camera in the reference memory according to the learn criteria (Col. 3, lines 10-44), as specified in Claims 5 and 25; and further comprising a second camera connected to provide image data to the interpreter, wherein the interpreter derives a three-dimensional image of the

Serial Number: 08/677100

-6-

Art Unit: 2615

space, and the reference memory, comparator, and output interface are adapted for processing three-dimensional image data (Col. 2, lines 50-52; Col. 10, lines 34-37; and Table I, [Cols. 4 and 6]), as specified in Claim 12.

Therefore, it would have been obvious that one of ordinary skill in the art, having Pomerleau and Sadovnik et al. before him/her, with Pomerleau disclosing a system that is trainable to learn the difference between the desired state and the undesired state, i.e., the learn and analysis functions of the interpreter for two and three dimensional image data, by employing a neural network; and Sadovnik teaching the details of applying a neural network to learn the difference between the desired state and the undesired state for two and three dimensional image data, and including the storage of image data from the camera for learning reference purposes, would have no difficulty in modifying Pomerleau to achieve the enhanced capability of a three dimensional recognizing system by applying a neural network to perform the learn and analysis functions of an interpreter for two and three dimensional image data.

Pomerleau does not particularly disclose details of a system wherein the camera is movably mounted, as specified in Claims 7, 16, 17 and 29.

Serial Number: 08/677100

-7-

Art Unit: 2615

Coutta teaches the well known details of a system, wherein the camera is movably mounted (Fig. 1; Col. 1, lines 47-50), as specified in Claims 7, 16, 17 and 29.

Therefore, it would have been obvious that one of ordinary skill in the art, having Pomerleau and Coutta before him/her, with Pomerleau disclosing a trainable security system comprised of a video camera for monitoring an area under surveillance, and Coutta teaching the details of a surveillance system employing a video camera that is movably mounted, would have no difficulty in modifying Pomerleau to obtain a system having whose surveillance function is enhanced by the use of a movably mounted camera.

Pomerleau does not particularly disclose details of a system, wherein the camera is mounted on a vehicle, as specified in Claims 8 and 29.

Urquhart teaches the well known details of a system, wherein the camera is mounted on a vehicle (Col. 1, lines 1-4 and 45-47), as specified in Claims 8 and 29.

Therefore, it would have been obvious that one of ordinary skill in the art, having Pomerleau and Urquhart before him/her, with Pomerleau disclosing a trainable security system comprised

Serial Number: 08/677100

-8-

Art Unit: 2615

of a video camera for monitoring an area under surveillance, and Urquhart teaching the details of a camera mounting system which allows photographs, or other imagery forms, to be taken from inside a surveillance vehicle, wherein the mounting bracket can be equipped with different equipment types, including a still camera, movie camera, video recording equipment, or combination of these, would have no difficulty in modifying Pomerleau to obtain a system whose surveillance function is further enhanced by the availability of vehicle mounted camera operation.

Pomerleau does not particularly disclose details of a monitoring system, wherein the interpreter is adapted for dividing image data into zones, and the comparator is adapted for comparing image data corresponding to the different zones with image data from the reference memory, according to different comparison criteria for each zone, as specified in Claims 18, 21 and 31; and wherein the interpreter is adapted for disregarding image data corresponding with a certain zone selected according to selected analysis criteria, as specified in Claims 19 and 32; and wherein the comparator is adapted for sequentially comparing the image data from the different zones, and discontinuing comparison of an image upon failure to meet the comparison criteria for the zone being compared, as specified in Claims 20 and 32.

Serial Number: 08/677100

-9-

Art Unit: 2615

Araki et al. teach the well known details of a monitoring system, wherein the interpreter is adapted for dividing image data into zones, and the comparator is adapted for comparing image data corresponding to the different zones with image data from the reference memory, according to different comparison criteria for each zone (Col. 5, lines 66-68 and Col. 6, lines 1-3), as specified in Claims 18, 21 and 31; and wherein the interpreter is adapted for disregarding image data corresponding with a certain zone selected according to selected analysis criteria (Col. 6, lines 20-27), as specified in Claims 19 and 32; and wherein the comparator is adapted for sequentially comparing the image data from the different zones, and discontinuing comparison of an image upon failure to meet the comparison criteria for the zone being compared (Col. 9, lines 1-6), as specified in Claims 20 and 32.

Therefore, it would have been obvious that one of ordinary skill in the art, having Pomerleau and Araki et al. before him/her, with Pomerleau disclosing a neural network, i.e., an interpreter, that can learn to discriminate between a person moving into a sensitive location in the scene and a person moving between the camera and the sensitive location, or, learn to discriminate movement from one location to another along a

Serial Number: 08/677100

-10-

Art Unit: 2615

particular trajectory in the scene, where such location discrimination corresponds to imagery data zonal discrimination; and Araki et al. teaching the details of an abnormality supervising, i.e., surveillance, system wherein the interpreter is adapted for dividing image data into zones, and the comparator is adapted for comparing image data corresponding to the different zones; wherein the interpreter is adapted for disregarding image data corresponding with a certain zone selected according to selected analysis criteria, and wherein the comparator is adapted for sequentially comparing the image data from the different zones, and discontinuing comparison of an image upon failure to meet the comparison criteria for the zone being compared; would have no difficulty in modifying Pomerleau to obtain a system applying a neural network, i.e., interpreter, wherein the interpreter is adapted for dividing image data into zones, and the comparator is adapted for comparing image data corresponding to the different zones, wherein the interpreter is adapted for disregarding image data corresponding with a certain zone selected according to selected analysis criteria; and wherein the comparator is adapted for sequentially comparing the image data from the different zones, and discontinuing comparison of an image upon failure to meet the comparison criteria for the zone being compared, to obtain a system whose surveillance

Serial Number: 08/677100

-11-

Art Unit: 2615

capability is enhanced by the use of neural networks employing such zonal processing functions.

Prior Art

3. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

(1) Mahoney (4,458,266) discloses a video surveillance motion detection system in which the screen display is divided into a matrix of elemental detection zones.

(2) Lafreniere (4,821,118) discloses a video image system for that includes hand palm and face personal identification.

(3) Maeno (5,283,644) discloses a crime prevention video monitor system that includes generation of face feature models.

(4) Hutcheson et al. discloses a neural network based pattern recognition system that includes 2D and 3D facial feature synthesis.

Serial Number: 08/677100

-12-

Art Unit: 2615

CONCLUSION

4. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Frank Snow whose telephone number is 703-305-4877.

The examiner can normally be reached on Monday-Thursday from 6:30 AM-5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tommy Chin, can be reached on 703-305-9508.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is 703-305-4700. Any fax communication should be sent to 703-308-5399.

Frank Snow

January 3, 1997

HOWARD W. BRITTON
PRIMARY EXAMINER
ART UNIT 2615

NOTICE OF DRAFTSPERSON'S PATENT DRAWING REVIEW

PTO Draftpersons review all originally filed drawings regardless of whether they are designated as formal or informal. Additionally, patent Examiners will review the drawings for compliance with the regulations. Direct telephone inquiries concerning this review to the Drawing Review Branch, 703-305-8404.

The drawings filed (insert date) 7/9/96, are
 A not objected to by the Draftsperson under 37 CFR 1.84 or 1.152.
 B objected to by the Draftsperson under 37 CFR 1.84 or 1.152 as indicated below. The Examiner will require submission of new, corrected drawings when necessary. Corrected drawings must be submitted according to the instructions on the back of this Notice.

1. DRAWINGS. 37 CFR 1.84(a): Acceptable categories of drawings:
 Black ink. Color.
 Not black solid lines. Fig(s) _____
 Color drawings are not acceptable until petition is granted.
 Fig(s) _____
2. PHOTOGRAPHS. 37 CFR 1.84(b)
 Photographs are not acceptable until petition is granted.
 Fig(s) _____
 Photographs not properly mounted (must use bristol board or photographic double-weight paper). Fig(s) _____
 Poor quality (half-tone). Fig(s) _____
3. GRAPHIC FORMS. 37 CFR 1.84 (d)
 Chemical or mathematical formula not labeled as separate figure.
 Fig(s) _____
 Group of waveforms not presented as a single figure, using common vertical axis with time extending along horizontal axis.
 Fig(s) _____
 Individuals waveform not identified with a separate letter designation adjacent to the vertical axis. Fig(s) _____
4. TYPE OF PAPER. 37 CFR 1.84(c)
 Paper not flexible, strong, white, smooth, nonshiny, and durable.
 Sheet(s) _____
 Erasures, alterations, overwritings, interlineations, cracks, creases, and folds copy machine marks not accepted. Fig(s) _____
 Mylar, velum paper is not acceptable (too thin). Fig(s) _____
5. SIZE OF PAPER. 37 CFR 1.84(f): Acceptable sizes:
 21.6 cm. by 35.6 cm. (8 1/2 by 14 inches)
 21.6 cm. by 33.1 cm. (8 1/2 by 13 inches)
 21.6 cm. by 27.9 cm. (8 1/2 by 11 inches)
 21.0 cm. by 29.7 cm. (DIN size A4)
 All drawing sheets not the same size. Sheet(s) _____
 Drawing sheet not an acceptable size. Sheet(s) _____
6. MARGINS. 37 CFR 1.84(g): Acceptable margins:
 Paper size

21.6 cm. X 35.6 cm.	21.6 cm. X 33.1 cm.	21.6 cm. X 27.9 cm.	21.0 cm. X 29.7 cm.
(8 1/2 X 14 inches)	(8 1/2 X 13 inches)	(8 1/2 X 11 inches)	(DIN Size A4)
T 5.1 cm. (2")	2.5 cm. (1")	2.5 cm. (1")	2.5cm.
L .64 cm. (1/4")	.64 cm. (1/4")	.64 cm. (1/4")	2.5 cm.
R .64 cm. (1/4")	.64 cm. (1/4")	.64 cm. (1/4")	1.5 cm.
B .64 cm. (1/4")	.64 cm. (1/4")	.64 cm. (1/4")	1.0 cm.

 Margins do not conform to chart above.
 Sheet(s) _____
 Top (T) Left (L) Right (R) Bottom (B)

7. VIEWS. 37 CFR 1.84(h)
 REMINDER: Specification may require revision to correspond to drawing changes.
 All views not grouped together. Fig(s) _____
 Views connected by projection lines or lead lines.
 Fig(s) _____
 Partial views. 37 CFR 1.84(h) 2

COMMENTS:

- View and enlarged view not labeled separately or properly.
 Fig(s) _____
- Sectional views. 37 CFR 1.84 (h) 3
- Hatching not indicated for sectional portions of an object.
 Fig(s) _____
- Cross section not drawn same as view with parts in cross section with regularly spaced parallel oblique strokes. Fig(s) _____
- 8. ARRANGEMENT OF VIEWS. 37 CFR 1.84(i)
 Words do not appear on a horizontal, left-to-right fashion when page is either upright or turned so that the top becomes the right side, except for graphs. Fig(s) _____
- 9. SCALE. 37 CFR 1.84(k)
 Scale not large enough to show mechanism with crowding when drawing is reduced in size to two-thirds in reproduction.
 Fig(s) _____
 Indication such as "actual size" or scale 1/2" not permitted.
 Fig(s) _____
- 10. CHARACTER OF LINES, NUMBERS, & LETTERS. 37 CFR 1.84(l)
 Lines, numbers & letters not uniformly thick and well defined, clean, durable, and black (except for color drawings).
 Fig(s) _____
- 11. SHADING. 37 CFR 1.84(m)
 Solid black shading areas not permitted.
 Fig(s) _____
 Shade lines, pale, rough and blurred. Fig(s) _____
- 12. NUMBERS, LETTERS, & REFERENCE CHARACTERS. 37 CFR 1.84(p)
 Numbers and reference characters not plain and legible. 37 CFR 1.84(p)(1) Fig(s) _____
 Numbers and reference characters not oriented in same direction as the view. 37 CFR 1.84(p)(1) Fig(s) _____
 English alphabet not used. 37 CFR 1.84(p)(2) Fig(s) _____
 Numbers, letters, and reference characters do not measure at least .32 cm. (1/8 inch) in height. 37 CFR(p)(3) Fig(s) _____
- 13. LEAD LINES. 37 CFR 1.84(q)
 Lead lines cross each other. Fig(s) _____
 Lead lines missing. Fig(s) _____
- 14. NUMBERING OF SHEETS OF DRAWINGS. 37 CFR 1.84(t)
 Sheets not numbered consecutively, and in Arabic numerals, beginning with number 1. Sheet(s) _____
- 15. NUMBER OF VIEWS. 37 CFR 1.84(u)
 Views not numbered consecutively, and in Arabic numerals, beginning with number 1. Fig(s) _____
 View numbers not preceded by the abbreviation Fig. Fig(s) _____
- 16. CORRECTIONS. 37 CFR 1.84(w)
 Corrections not made from prior PTO-948.
 Fig(s) _____
- 17. DESIGN DRAWING. 37 CFR 1.152
 Surface shading shown not appropriate. Fig(s) _____
 Solid black shading not used for color contrast.
 Fig(s) _____

59087 U.S. PTO



04/21/97

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicants: John B. Adrain
Serial No.: 08/677,100 Art Unit: 2615
Filing Date: July 9, 1996
Title: "FACILITY MONITORING SYSTEM WITH IMAGE MEMORY AND CORRELATION"
Examiner: Howard W. Britton
Docket No.: 29520

GROUP 2600
MY - 7 97
RECEIVED

AMENDMENT "A"
(IN RESPONSE TO PAPER NO. 3)

Asst. Commissioner for Patents
BOX NON-FEE AMENDMENTS
Washington, D.C. 20231

Sir:

This amendment is filed in response to the Office action dated January 13, 1997. Please amend the above-identified application in the following manner.

IN THE CLAIMS:

Please cancel claims 7, 9, 11, 13, 24, 27 and 28 without prejudice.

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231 on the date indicated below.

Michael W. Garvey
Name of Attorney
for Applicant(s)

4-14-97
Date Signature of Attorney

A000073

Please amend claims 1 and 8 as follows:

Claim 1, line 2, after the first occurrence of "a",
please insert therefor --movably mounted--.

Claim 8, line 1, please delete "7" and insert
therefor --1--

Please amend claims 15, 22 and 23 as follows:

A/
Comp

SUBP2

15. (amended) [a monitoring system according to
claim 1 wherein the reference memory is adapted for
storing image data] A monitoring system comprising:
a movably mounted camera adapted for receiving
images of a space to be monitored;
an interpreter for receiving image data from
the camera;
a reference memory for storing reference image
data for plural images and [the] a comparator is adapted
for comparing image data from the interpreter to image
data for the plural images from the reference memory
according to selected comparison criteria; and
an output interface for reporting results of
the image data comparisons performed by the comparator.

A/
Comp

SUBP3

22. (amended) A method of monitoring a space
comprising the steps of:

3 receiving a first set of image data from the
4 space representing plural images;
5 identifying and selecting a portion of the
6 information to be stored according to analysis and learn
7 criteria;
8 storing the selected information;
9 receiving a second set of image data from the
10 space;
11 identifying and selecting a portion of the
12 second set of image data to be analyzed according to the
13 analysis criteria;
14 comparing the selected portions of the sets of
15 image data to each other so as to compare the second set
16 of image data to the plural images of the first set and
17 determine a correlation of the images; and
18 indicating whether the correlation of the
19 images meets selected comparison criteria.

13.
1 23. (amended) A method according to claim 22
2 further comprising the step of reporting results of the
3 comparison step according to utilization criteria and
4 augmenting the reporting with identifying information.

Please add new claims 33-38 as follows:

1 ^{9.}~~33.~~ (new) A system according to claim 1 wherein
2 the interpreter selects images according to analysis
3 criteria so that only the selected images are input to
4 the comparator for comparison to reference images.

1 ^{10.}~~34.~~ (new) A system according to claim ~~33~~ ^{9.} wherein
2 the selected images represent only portions of a larger
3 image.

1 ^{35.}~~34.~~ (new) A system according to claim 21 wherein
2 the comparator compares the image data from each zone to
3 a different reference image.

1 ^{36.}~~35.~~ (new) A method according to claim 30 wherein
2 the step of storing changes from the baseline data is
3 performed according to learn criteria and substantially
4 coincident with comparisons being performed by the
5 comparator.

1 ^{37.}~~36.~~ (new) A method according to claim 36, wherein
2 the baseline data are changed based on results of a
3 comparison.

1 ^{20.}~~38.~~ (new) A method according to claim ~~22~~ ¹² wherein
2 the comparison of image data is repeated to distinguish
3 between movements based on a series of sequential images.

REMARKS

Claims 1-32 have been rejected as obvious over Pomerleau in view of Sadovnik, Coutta, Urquhart, and Araki.

Claim 1 has been amended to more clearly distinguish the invention over the prior art, incorporating the substance of claim 7. The cited art does not show a moving or movable camera as recited in claims 1, 8, and 16. Although it is well known to mount a camera on a movable support or movably mount a camera on a stationary support, there is no suggestion in the art to do so in combination with the system shown in Pomerleau.

Pomerleau compares two images of the same space and creates a difference image. If the camera moves between the times when the two images are recorded, nearly every pixel in the difference image would indicate a change condition. Pomerleau does not teach that the system would know which image to use as a reference when the camera monitors a different space.

The present invention, however, specifically provides that the camera can move, for example, being mounted on a vehicle. As the space being monitored changes, the interpreter selects certain parts of the image for comparison and disregards other parts of the image according to analysis criteria from the programmer. For example, a system seeking license plates would only

make comparisons when a license plate is discovered. The comparison could be limited to the license plate without regard for surrounding images. New claims 33 and 34 have been added to further distinguish over the cited art.

Claim 15 has been rewritten in independent form. The cited art does not show a comparator that uses different reference images under different circumstances according to selected comparison criteria as recited in claims 15-17. For example, monitoring of a bank vault compares facial images during the day, but uses the unoccupied vault as the reference at night. The references do not show repeated comparisons used to sense types of movement in the monitored space as recited in new claim 38.

The cited art does not divide the image data into zones and use different comparison criteria for the different zones according to claims 18-21 and 31-32. Pomerleau merely applies different weights to different parts of the difference image. Furthermore, the cited art does not make sequential comparisons in the zones as recited in claims 20 and 32. Pomerleau makes a single comparison of the entire image. The cited art does not use different reference images for the different zones according to claim 35. Pomerleau uses a single reference image. The cited art does not show comparison of the sensed images to plural stored images as recited in claim 22.

The references do not show the step of augmenting the reporting of comparison results with identifying information as recited in claim 23.

The references do not show an interpreter that periodically stores reference images in memory according to learn criteria as recited in claim 14. The references do not show a system that stores changes from the baseline data as recited in claims 30 and new claim 36. The references do not show baseline data that are changed based on results of a comparison as recited in new claim 37. For example, the image of a new face can be automatically stored in the reference memory when it appears in the monitored space with a previously stored face image. Thus, the invention can learn by updating the reference images during operation according to learn criteria. Pomerleau requires the user to teach the system by recording reference images.

Claims 7, 9, 11, 13, 24, 27 and 28 have been cancelled.

All of the issues raised by the Examiner have been resolved. Accordingly, applicant respectfully requests reconsideration and withdrawal of the rejection.

If there are any additional fees resulting from this communication, please charge all uncovered fees to our Deposit Account No. 16-0820, our Order No. 29520.

Respectfully submitted,

PEARNE, GORDON, MCCOY & GRANGER LLP

By 
Michael W. Garvey, Reg. No. 35878

1200 Leader Building
Cleveland, Ohio 44114
(216) 579-1700

April 14, 1997



**UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office**

Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

APPLICATION NO. 08/777,144	FILING DATE 07/07/96	FIRST NAMED INVENTOR ADRAIN	ATTORNEY DOCKET NO. 29520
-------------------------------	-------------------------	--------------------------------	------------------------------

PEARNE GORDON MCCOY & GRANGER
1200 LEADER BLDG
CLEVELAND OH 44114

26N2/0805

EXAMINER

SNOW, F

ART UNIT 2615	PAPER NUMBER 5
------------------	-------------------

DATE MAILED: 08/05/97

Please find below and/or attached an Office communication concerning this application or proceeding.

Commissioner of Patents and Trademarks

Office Action Summary

Application No. 08/677,100	Applicant(s) Adrain
Examiner Frank Snow	Group Art Unit 2615



Responsive to communication(s) filed on Apr 14, 1997.

This action is **FINAL**.

Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11; 453 O.G. 213.

A shortened statutory period for response to this action is set to expire THREE month(s), or thirty days, whichever is longer, from the mailing date of this communication. Failure to respond within the period for response will cause the application to become abandoned. (35 U.S.C. § 133). Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Disposition of Claims

- Claim(s) 1-6, 8, 12, 14-23, 25, 26, and 29-38 is/are pending in the application.
- Of the above, claim(s) _____ is/are withdrawn from consideration.
- Claim(s) _____ is/are allowed.
- Claim(s) 1-6, 8, 12, 14-23, 25, 26, and 29-38 is/are rejected.
- Claim(s) _____ is/are objected to.
- Claims _____ are subject to restriction or election requirement.

Application Papers

- See the attached Notice of Draftsperson's Patent Drawing Review, PTO-948.
- The drawing(s) filed on _____ is/are objected to by the Examiner.
- The proposed drawing correction, filed on _____ is approved disapproved.
- The specification is objected to by the Examiner.
- The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. § 119

- Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).
- All Some* None of the CERTIFIED copies of the priority documents have been received.
- received in Application No. (Series Code/Serial Number) _____.
- received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____.

- Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

Attachment(s)

- Notice of References Cited, PTO-892
- Information Disclosure Statement(s), PTO-1449, Paper No(s). _____
- Interview Summary, PTO-413
- Notice of Draftsperson's Patent Drawing Review, PTO-948
- Notice of Informal Patent Application, PTO-152

--- SEE OFFICE ACTION ON THE FOLLOWING PAGES ---

Serial Number: 08/677100

Page 2

Art Unit: 2615

Part III DETAILED ACTION

Response to Amendment

1. This action is in response to applicant's amendment received 14 April 1997, in which applicant cancels claims 7, 9, (and claim 10, being dependent on claim 9), 11, 13, 24, 27 and 28; amends claims 15, 22 and 23; and adds claims 33-38. The total claim set becoming claims 1-6, 8, 12, 14-23, 25, 26 and 29-38.

2. Applicant's arguments filed 4/14/97 have been fully considered, but they are not deemed to be persuasive.

Claim Rejections - 35 USC § 103

3. The following is a quotation of 35 U.S.C. § 103 which forms the basis for all obviousness rejections set forth in this Office action:

A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Serial Number: 08/677100

Page 3

Art Unit: 2615

Subject matter developed by another person, which qualifies as prior art only under subsection (f) or (g) of section 102 of this title, shall not preclude patentability under this section where the subject matter and the claimed invention were, at the time the invention was made, owned by the same person or subject to an obligation of assignment to the same person.

4. Claims 1-6, 8, 12, 14-23, 25, 26 and 29-38 are rejected under 35 U.S.C. § 103 as being unpatentable over Pomerleau (5,091,780) in view of Sadovnik et al. (5,497,430), Coutta (4,337,482), Urquhart (4,514,068) and Araki et al. (4,737,847).

Regarding claims 1-6, 8, 12, 14, 16-21, 25, 26 and 29-32:

Claims 1-6, 8, 12, 14, 16-21, 25, 26 and 29-32 are rejected for the same reasons as previously set forth in paragraph 2 of the last office action, paper no. 3.

Regarding amended claims 15, 22 and 23:

The presented art of the previous action discloses substantially the same system and method for a monitoring system comprising a movably mounted camera, an interpreter, a reference

Serial Number: 08/677100

Page 4

Art Unit: 2615

wherein, comprising the steps of receiving a first set of image data, identifying and selecting a portion of the information, storing the selected information, receiving a second set of image data from the space, identifying and selecting a portion of the second set of image data, comparing the selected portions of the sets of image data to each, and indicating whether the correlation of the images meets selected comparison criteria (see previous action discussion for claims 1, 15 and 22), as specified in claim 22; and

wherein, comprising the step of reporting results of the comparison step according to utilization criteria and augmenting the reporting with identifying information ("augmenting information" is inherent in "reporting the results") (see previous action discussion for claims 1, 15, 22 and 23), as specified in claim 23.

Regarding added claims 33-38:

The presented art of the previous action discloses substantially the same system and method for a monitoring system including wherein, the interpreter selects images (see previous

Serial Number: 08/677100

Page 5

Art Unit: 2615

action discussion for claims 1, 2 and 3), as specified in claim 33; and

wherein, the selected images represent only portions of a larger image (see previous action discussion for claims 1 and 18), as specified in claim 34; and

wherein, the comparator compares the image data from each zone to a different reference image (see previous action discussion for claims 1 and 21, e.g., "different reference image" is inherent in "different criteria", as this is an image system), as specified in claim 35; and

wherein, the step of storing changes from the baseline data is performed according to learn criteria and substantially coincident with comparisons being performed by the comparator (see previous action discussion for claims 22 and 30, e.g., "learn criteria" is inherent in "establishing baseline image data", as the previously referenced prior art addresses image learning processes) (amendment of claim 22 to include "plural images" is addressed below), as specified in claim 36; and

Serial Number: 08/677100

Page 6

Art Unit: 2615

wherein, the baseline data are changed based on result comparison (see above discussion for claim 36, e.g., "result comparison" is inherent in the referenced prior art image learning processes), as specified in claim 37; and

wherein, the comparison of image data is repeated to distinguish between movements based on a series of sequential images (repetition of image data comparison and consequential sequential-image-based distinguishing between movements is inherent in the referenced prior art image learning processes) (amendment of claim 22 is addressed below), as specified in claim 38.

Response to Application's Remarks

4. The following is examiner's response to applicant's remarks:

Regarding applicant's indication that Pomerleau does not teach that the system would know which image to use as a reference when the camera monitors a different space, Pomerleau provides, for example, an extensive discussion of image reference needs and technical solutions for intelligent use of provided

Serial Number: 08/677100

Page 7

Art Unit: 2615

reference image criteria and associated response to such criteria (see full text of Background of the Invention and Summary of the Invention).

Additionally, examiner has applied the combined references of Pomerleau and Araki (see, for example, examiner's previously provided reference elements for claims 18-21 and 31-32) to establish that reference image use for different spaces would be obvious.

Response to Arguments

5. In response to applicant's arguments against the references individually, one cannot show non-obviousness by attacking references individually where the rejections are based on combinations of references. *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co., Inc.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986).

Applicant's arguments with respect to claims 1, 8, 14-23 and 30-32, are moot as references have previously been cited to establish obviousness.

Serial Number: 08/677100

Page 8

Art Unit: 2615

Conclusion

6. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL.** See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for response to this final action is set to expire THREE MONTHS from the date of this action. In the event a first response is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event will the statutory period for response expire later than SIX MONTHS from the date of this final action.

7. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Frank Snow whose telephone number is 703-305-4877.

Serial Number: 08/677100

Page 9

Art Unit: 2615

The examiner can normally be reached on Monday-Thursday from 6:30 AM-5:00 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Tommy Chin, can be reached on 703-305-9508.

Any inquiry of a general nature or relating to the status of this application should be directed to the Group receptionist whose telephone number is 703-305-4700. Any fax communication should be sent to 703-308-5399.

Frank Snow

July 24, 1997

~~FRANK S. SNOW~~
~~TOMMY P. CHIN~~
SUPERVISORY PATENT EXAMINER
GROUP 2600



UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office
Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

APPLICATION NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NO.
08/677,100			

EXAMINER	
FRANK SNOW	
ART UNIT	PAPER NUMBER
6	

DATE MAILED:

INTERVIEW SUMMARY

All participants (applicant, applicant's representative, PTO personnel):

(1) FRANK SNOW (PTO) (3) HOWARD BRITTON (PTO)
 (2) MICHAEL GARVEY (ATN) JOHN ADRAIN (INVENTOR)
 Date of interview 1/20/98

Type: Telephonic Personal (copy is given to applicant applicant's representative).Exhibit shown or demonstration conducted: Yes No If yes, brief description: _____Agreement was reached. was not reached.Claim(s) discussed: 1,15

Identification of prior art discussed: _____

Description of the general nature of what was agreed to if an agreement was reached, or any other comments:

Discussed proposed claim changes.

(A fuller description, if necessary, and a copy of the amendments, if available, which the examiner agreed would render the claims allowable must be attached. Also, where no copy of the amendments which would render the claims allowable is available, a summary thereof must be attached.)

1. It is not necessary for applicant to provide a separate record of the substance of the interview.

Unless the paragraph above has been checked to indicate to the contrary, A FORMAL WRITTEN RESPONSE TO THE LAST OFFICE ACTION IS NOT WAIVED AND MUST INCLUDE THE SUBSTANCE OF THE INTERVIEW. (See MPEP Section 713.04). If a response to the last Office action has already been filed, APPLICANT IS GIVEN ONE MONTH FROM THIS INTERVIEW DATE TO FILE A STATEMENT OF THE SUBSTANCE OF THE INTERVIEW.

2. Since the Examiner's interview summary above (including any attachments) reflects a complete response to each of the objections, rejections and requirements that may be present in the last Office action, and since the claims are now allowable, this completed form is considered to fulfill the response requirements of the last Office action. Applicant is not relieved from providing a separate record of the interview unless box 1 above is also checked.

Examiner Note: You must sign this form unless it is an attachment to another form.

FORM PTOL-413 (REV.1-98) Frank Snover 1/20/98

HOWARD BRITTON
PRIMARY EXAMINER
A000091



#61B
PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: John B. Adrian
Serial No.: 08/677,100 Art Unit: 2615
Filed: July 9, 1996
Title: "FACILITY MONITORING SYSTEM WITH IMAGE MEMORY AND CORRELATION"
Examiner: Frank Snow
Docket No.: 29520

AMENDMENT AND REQUEST FOR EXTENSION OF TIME

Assistant Commissioner for Patents
Washington D.C. 20231

Sir:

This communication is filed in response to the Office Action dated August 5, 1997. The 3 month period for responding to the Communication expired on November 5, 1997. Accordingly, applicant respectfully requests and petitions that the response date be extended, for 3 months, to February 5, 1998. The \$475.00 extension of time fee is enclosed.

Please amend the above-identified application as follows.

IN THE CLAIMS:

Please cancel claims 12, 14, 16-21, and 35-37 without prejudice.

Claim 10, line 1, delete "9" and insert --1--.

1 1. (twice amended) A monitoring system comprising:
2 a movably mounted camera adapted for receiving
3 images of a space to be monitored;
4 an interpreter for receiving image data from
5 the camera;
6 a reference memory for storing reference image
7 data;
8 a comparator connected for comparing image data
9 from the interpreter to image data from the reference
10 memory according to selected comparison criteria, wherein
11 the interpreter and comparator cooperate to select
12 recognizable portions of image data among unrecognized
13 portions of image data in the space being monitored, the
14 selected image portions being compared to the image data
15 in the reference memory; and
16 an output interface for reporting results of
17 the image data comparisons performed by the comparator.

1 11.
2 15. (twice amended) A monitoring system comprising:
3 a movably mounted camera adapted for receiving
4 images of a space to be monitored;
5 an interpreter for receiving image data from
6 the camera;
7 a reference memory for storing reference image
8 data for plural images and a comparator [is] adapted for
9 comparing image data from the interpreter to image data
10 for the plural images from the reference memory according
11 to selected comparison criteria, wherein the interpreter
12 and comparator cooperate to select recognizable portions
13 of image data among unrecognized portions of image data
14 in the space being monitored, the selected image portions
15 being compared to the image data in the reference memory;
16 and
17 an output interface for reporting results of
18 the image data comparisons performed by the comparator.

12.

1 22. (twice amended) A method of monitoring a space
2 comprising the steps of:
3 receiving a first set of image data from the
4 space representing plural images;
5 identifying and selecting a portion of the
6 information to be stored according to analysis and learn
7 criteria;
8 storing the selected information;
9 receiving a second set of image data from the
10 space;
11 identifying and selecting a portion of the
12 second set of image data to be analyzed according to the
13 analysis criteria, wherein the selected portion
14 represents a recognizable portion of image data among
15 unrecognized portions of image data in the space being
16 monitored;
17 comparing the selected portions of the sets of
18 image data to each other so as to compare the second set
19 of image data to the plural images of the first set and
20 determine a correlation of the images; and
21 indicating whether the correlation of the
22 images meets selected comparison criteria.

B-Conf

REMARKS

Applicant thanks examiners Snow and Britton for meeting the inventor and his attorney on January 20, 1998. The interview was helpful in resolving the outstanding issues in the application.

Claims 1, 10, 15, and 22 have been amended to more clearly define the invention. Claims 12, 14, 16-21, 35-37 have been cancelled.

Claims 1, 15, and 22 have been rejected as obvious.

None of the references teach selection of recognizable portions of image data from among unrecognizable portions of image data. This feature enables the invention to use a moving camera, mounted on

a vehicle for example. Changing background images can be disregarded while relevant objects are identified and analyzed. For example, all images would be ignored except those appearing as license plates, which would be analyzed, as described in the specification beginning at page 10, line 9.

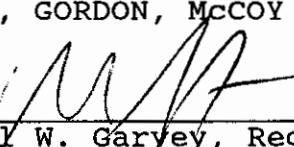
All of the issues raised by the Examiner have been resolved. Accordingly, applicant respectfully requests reconsideration and withdrawal of the rejection.

If there are any fees required by the foregoing Amendment, please charge the same to our Deposit Account No. 16-0820, our Order No. 29520.

Respectfully submitted,

PEARNE, GORDON, MCCOY & GRANGER

By:


Michael W. Garvey, Reg. No. 35878

1200 Leader Building
Cleveland, Ohio 44114
(216) 579-1700

February 4, 1998



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3-31-98

PTO/SB/29 (12/97)

Approved for use through 09/30/00. OMB 0651-0032
Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

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CONTINUED PROSECUTION APPLICATION (CPA) REQUEST TRANSMITTAL

*Submit an original, and a duplicate for fee processing.
(Only for Continuation or Divisional applications under 37 CFR 1.53(d))*

CHECK BOX, if applicable

DUPLICATE

Address to:

Assistant Commissioner for Patents
Box CPA
Washington, DC 20231

Attorney Docket No.	29520
First Named Inventor	John B. Adrain
Express Mail Label No.	EM171101583US
Total Pages	-6-

This is a request for a continuation or divisional application under 37 CFR 1.53(d),
(continued prosecution application (CPA)) of prior application number 08/677,100,
filed on July 9, 1996, entitled FACILITY MONITORING SYSTEM WITH IMAGE MEMORY AND
CORRELATION

NOTES

FILING QUALIFICATIONS: The prior application identified above must be a nonprovisional application that is either: (1) complete as defined by 37 CFR 1.51(b) and filed on or after June 8, 1995, or (2) the national stage of an international application in compliance with 35 U.S.C. 371 and filed on or after June 8, 1995.

C-I-P NOT PERMITTED: A continuation-in-part application cannot be filed as a CPA under 37 CFR 1.53(d), but must be filed under 37 CFR 1.53(b).

EXPRESS ABANDONMENT OF PRIOR APPLICATION: The filing of this CPA is a request to expressly abandon the prior application as of the filing date of the request for a CPA. 37 CFR 1.53(b) must be used to file a continuation, divisional, or continuation-in-part of an application that is not to be abandoned.

ACCESS TO PRIOR APPLICATION: The filing of this CPA will be construed to include a waiver of confidentiality by the applicant under 35 U.S.C. 122 to the extent that any member of the public who is entitled under the provisions of 37 CFR 1.14 to access to, copies of, or information concerning, the prior application may be given similar access to, copies of, or similar information concerning, the other application or applications in the file jacket.

35 U.S.C. 120 STATEMENT: In a CPA, no reference to the prior application is needed in the first sentence of the specification and none should be submitted. If a sentence referencing the prior application is submitted, it will not be entered. A request for a CPA is the specific reference required by 35 U.S.C. 120 and to every application assigned the application number identified in such request, 37 CFR 1.78(a).

1. Enter the unentered amendment previously filed on _____ under 37 CFR 1.116 in the prior nonprovisional application.
2. A preliminary amendment is enclosed.
3. This application is filed by fewer than all the inventors named in the prior application, 37 CFR 1.53 (d)(4).
 - a. **DELETE** the following inventor(s) named in the prior nonprovisional application:
.....
.....
.....
 - b. The inventor(s) to be deleted are set forth on a separate sheet attached hereto.
4. A new power of attorney or authorization of agent (PTO/SB/81) is enclosed.
5. Information Disclosure Statement (IDS) is enclosed:
 - a. PTO-1449
 - b. Copies of IDS Citations

[Page 1 of 2]

Burden Hour Statement: This form is estimated to take 0.4 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Box CPA, Washington, DC 20231.

(S)

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PTO/SB/29 (12/97)

Approved for use through 09/30/00. OMB 0651-0032

Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

CLAIMS	(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) CALCULATIONS
	TOTAL CLAIMS (37 CFR 1.16(c))	0 -20 =	0	x \$ _____ =	\$ -0-
	INDEPENDENT CLAIMS (37 CFR 1.16(b))	0 -3 =	0	x \$ _____ =	\$ -0-
	MULTIPLE DEPENDENT CLAIMS (if applicable) (37 CFR 1.16(d))			+ \$ _____ =	\$ -0-
				BASIC FEE (37 CFR 1.16(a))	\$ 395.00
				Total of above Calculations =	\$ 395.00
				Reduction by 50% for filing by small entity (Note 37 CFR 1.9, 1.27, 1.28).	\$
				TOTAL =	\$ 395.00

6. Small entity status:

- a. A small entity statement is enclosed.
- b. A small entity statement was filed in the prior nonprovisional application and such status is still proper and desired.
- c. Is no longer claimed.

7. The Commissioner is hereby authorized to credit overpayments or charge the following fees to Deposit Account No. 16-0820: Order No. 29520

- a. Fees required under 37 CFR 1.16.
- b. Fees required under 37 CFR 1.17.
- c. Fees required under 37 CFR 1.18.

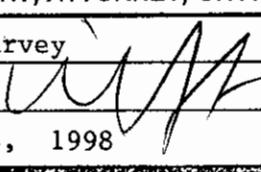
8. A check in the amount of \$ \$395.00 is enclosed.9. Other:

NOTE: *The prior application's correspondence address will carry over to this CPA UNLESS a new correspondence address is provided below.*

10. NEW CORRESPONDENCE ADDRESS

<input type="checkbox"/> Customer Number or Bar Code Label	(Insert Customer No. or Attach bar code label here)		<input type="checkbox"/> New correspondence address below
NAME	Michael W. Garvey Pearne, Gordon, McCoy & Granger		
ADDRESS	1200 Leader Building		
CITY	Cleveland	STATE	Ohio
COUNTRY	U.S.A.	TELEPHONE	216-579-1700
		ZIP CODE	44114
		FAX	216-579-6073

11. SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

NAME	Michael W. Garvey
SIGNATURE	
DATE	February 4, 1998



Please type a plus sign (+) inside this box →

6 PAGS
J

PTO/SB/29 (12/97)

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Patent and Trademark Office: U.S. DEPARTMENT OF COMMERCE

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number.

CONTINUED PROSECUTION APPLICATION (CPA) REQUEST TRANSMITTAL

*Submit an original, and a duplicate for fee processing.
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CHECK BOX, if applicable
 DUPLICATE

Address to:	Attorney Docket No.	29520
	First Named Inventor	John B. Adrain
	Express Mail Label No.	EM171101583US
	Total Pages	-6-

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(continued prosecution application (CPA)) of prior application number 08 /677,100,
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NOTES

FILING QUALIFICATIONS: The prior application identified above must be a nonprovisional application that is either: (1) complete as defined by 37 CFR 1.51(b) and filed on or after June 8, 1995, or (2) the national stage of an international application in compliance with 35 U.S.C. 371 and filed on or after June 8, 1995.

C-I-P NOT PERMITTED: A continuation-in-part application cannot be filed as a CPA under 37 CFR 1.53(d), but must be filed under 37 CFR 1.53(b).

EXPRESS ABANDONMENT OF PRIOR APPLICATION: The filing of this CPA is a request to expressly abandon the prior application as of the filing date of the request for a CPA. 37 CFR 1.53(b) must be used to file a continuation, divisional, or continuation-in-part of an application that is not to be abandoned.

ACCESS TO PRIOR APPLICATION: The filing of this CPA will be construed to include a waiver of confidentiality by the applicant under 35 U.S.C. 122 to the extent that any member of the public who is entitled under the provisions of 37 CFR 1.14 to access to, copies of, or information concerning, the prior application may be given similar access to, copies of, or similar information concerning, the other application or applications in the file jacket.

35 U.S.C. 120 STATEMENT: In a CPA, no reference to the prior application is needed in the first sentence of the specification and none should be submitted. If a sentence referencing the prior application is submitted, it will not be entered. A request for a CPA is the specific reference required by 35 U.S.C. 120 and to every application assigned the application number identified in such request, 37 CFR 1.78(a).

1. Enter the unentered amendment previously filed on _____ under 37 CFR 1.116 in the prior nonprovisional application.
2. A preliminary amendment is enclosed.
3. This application is filed by fewer than all the inventors named in the prior application, 37 CFR 1.53 (d)(4).
 - a. **DELETE** the following inventor(s) named in the prior nonprovisional application:
.....
.....
.....
 - b. The inventor(s) to be deleted are set forth on a separate sheet attached hereto.
4. A new power of attorney or authorization of agent (PTO/SB/81) is enclosed.
5. Information Disclosure Statement (IDS) is enclosed:
 - a. PTO-1449
 - b. Copies of IDS Citations

[Page 1 of 2]

Burden Hour Statement: This form is estimated to take 0.4 hours to complete. Time will vary depending upon the needs of the individual case. Any comments on the amount of time you are required to complete this form should be sent to the Chief Information Officer, Patent and Trademark Office, Washington, DC 20231. DO NOT SEND FEES OR COMPLETED FORMS TO THIS ADDRESS. SEND TO: Assistant Commissioner for Patents, Box CPA, Washington, DC 20231.

A000098

Please type a plus sign (+) inside this box →

PTO/SB/29 (12/97)

Approved for use through 09/30/00. OMB 0651-0032
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CLAIMS	(1) FOR	(2) NUMBER FILED	(3) NUMBER EXTRA	(4) RATE	(5) CALCULATIONS
	TOTAL CLAIMS (37 CFR 1.16(c))	0 -20 =	0	x \$ _____ =	\$ -0-
	INDEPENDENT CLAIMS (37 CFR 1.16(b))	0 -3 =	0	x \$ _____ =	\$ -0-
	MULTIPLE DEPENDENT CLAIMS (if applicable) (37 CFR 1.16(d))			+ \$ _____ =	\$ -0-
				BASIC FEE (37 CFR 1.16(a))	\$ 395.00
				Total of above Calculations =	\$ 395.00
				Reduction by 50% for filing by small entity (Note 37 CFR 1.9, 1.27, 1.28).	\$
				TOTAL =	\$ 395.00

6. Small entity status:

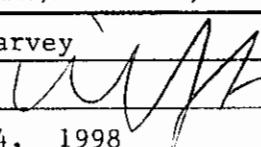
- a. A small entity statement is enclosed.
 - b. A small entity statement was filed in the prior nonprovisional application and such status is still proper and desired.
 - c. Is no longer claimed.
7. The Commissioner is hereby authorized to credit overpayments or charge the following fees to Deposit Account No. 16 - 0820: Order No. 29520
- a. Fees required under 37 CFR 1.16.
 - b. Fees required under 37 CFR 1.17.
 - c. Fees required under 37 CFR 1.18.
8. A check in the amount of \$ \$395.00 is enclosed.
9. Other:

NOTE: The prior application's correspondence address will carry over to this CPA
UNLESS a new correspondence address is provided below.

10. NEW CORRESPONDENCE ADDRESS

<input type="checkbox"/> Customer Number or Bar Code Label	(Insert Customer No. or Attach bar code label here)		<input type="checkbox"/> New correspondence address below
NAME	Michael W. Garvey Pearne, Gordon, McCoy & Granger		
ADDRESS	1200 Leader Building		
CITY	Cleveland	STATE	Ohio
COUNTRY	U.S.A.	TELEPHONE	216-579-1700
		ZIP CODE	44114
		FAX	216-579-6073

11. SIGNATURE OF APPLICANT, ATTORNEY, OR AGENT REQUIRED

NAME	Michael W. Garvey
SIGNATURE	
DATE	February 4, 1998



**UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office**

Address: COMMISSIONER OF PATENTS AND TRADEMARKS
Washington, D.C. 20231

SERIAL NUMBER	FILING DATE	FIRST NAMED APPLICANT	ATTORNEY DOCKET NO.
10/22/06 06/26/06 MARY ANNE CURRIN MURDOY A CHAMBERS			

MARY ANNE CURRIN MURDOY A CHAMBERS
1200 LEADER BLDG
CLEVELAND OH 44114

ART UNIT 117	EXAMINER
ART UNIT 118	PAPER NUMBER
76/05/06	

DATE MAILED:

Please find below a communication from the EXAMINER in charge of this application.

Commissioner of Patents

Notice of Allowability	Application No.	Applicant(s)
	08/677,100	J. B. Adrain
	Examiner	Group Art Unit
	Howard W. Britton	2713



All claims being allowable, PROSECUTION ON THE MERITS IS (OR REMAINS) CLOSED in this application. If not included herewith (or previously mailed), a Notice of Allowance and Issue Fee Due or other appropriate communication will be mailed in due course.

This communication is responsive to amendment filed 2-4-98.

The allowed claim(s) is/are 1-6, 8, 10, 15, 22-23, 25-25, 29-34 and 38 renumbered as 1-8, 11-19, 9, 10 and 20.

The drawings filed on _____ are acceptable.

Acknowledgement is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d).

All Some* None of the CERTIFIED copies of the priority documents have been received.

received in Application No. (Series Code/Serial Number) _____.

received in this national stage application from the International Bureau (PCT Rule 17.2(a)).

*Certified copies not received: _____.

Acknowledgement is made of a claim for domestic priority under 35 U.S.C. § 119(e).

A SHORTENED STATUTORY PERIOD FOR RESPONSE to comply with the requirements noted below is set to EXPIRE THREE MONTHS FROM THE "DATE MAILED" of this Office action. Failure to timely comply will result in ABANDONMENT of this application. Extensions of time may be obtained under the provisions of 37 CFR 1.136(a).

Note the attached EXAMINER'S AMENDMENT or NOTICE OF INFORMAL APPLICATION, PTO-152, which discloses that the oath or declaration is deficient. A SUBSTITUTE OATH OR DECLARATION IS REQUIRED.

Applicant MUST submit NEW FORMAL DRAWINGS

because the originally filed drawings were declared by applicant to be informal.

including changes required by the Notice of Draftsperson's Patent Drawing Review, PTO-948, attached hereto or to Paper No. 3.

including changes required by the proposed drawing correction filed on _____, which has been approved by the examiner.

including changes required by the attached Examiner's Amendment/Comment.

Identifying indicia such as the application number (see 37 CFR 1.84(c)) should be written on the reverse side of the drawings. The drawings should be filed as a separate paper with a transmittal letter addressed to the Official Draftsperson.

Note the attached Examiner's comment regarding REQUIREMENT FOR THE DEPOSIT OF BIOLOGICAL MATERIAL.

Any response to this letter should include, in the upper right hand corner, the APPLICATION NUMBER (SERIES CODE/SERIAL NUMBER). If applicant has received a Notice of Allowance and Issue Fee Due, the ISSUE BATCH NUMBER and DATE of the NOTICE OF ALLOWANCE should also be included.

Attachment(s)

- Notice of References Cited, PTO-892
- Information Disclosure Statement(s), PTO-1449, Paper No(s). _____
- Notice of Draftsperson's Patent Drawing Review, PTO-948
- Notice of Informal Patent Application, PTO-152
- Interview Summary, PTO-413
- Examiner's Amendment/Comment
- Examiner's Comment Regarding Requirement for Deposit of Biological Material
- Examiner's Statement of Reasons for Allowance


HOWARD W. BRITTON
PRIMARY EXAMINER
ART UNIT 2713



UNITED STATES DEPARTMENT OF COMMERCE
Patent and Trademark Office

NOTICE OF ALLOWANCE AND ISSUE FEE DUE

APPLICATION NO.	FILING DATE	TOTAL CLAIMS	EXAMINER AND GROUP ART UNIT	DATE MAILED		
First Named Applicant						
TITLE OF INVENTION						
ATTY'S DOCKET NO.	CLASS-SUBCLASS	BATCH NO.	APPLN. TYPE	SMALL ENTITY	FEES DUE	DATE DUE

**THE APPLICATION IDENTIFIED ABOVE HAS BEEN EXAMINED AND IS ALLOWED FOR ISSUANCE AS A PATENT.
PROSECUTION ON THE MERITS IS CLOSED.**

**THE ISSUE FEE MUST BE PAID WITHIN THREE MONTHS FROM THE MAILING DATE OF THIS NOTICE OR THIS
APPLICATION SHALL BE REGARDED AS ABANDONED. THIS STATUTORY PERIOD CANNOT BE EXTENDED.**

HOW TO RESPOND TO THIS NOTICE:

I. Review the SMALL ENTITY status shown above.

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- A. Pay FEE DUE shown above, or
- B. File verified statement of Small Entity Status before, or with, payment of 1/2 the FEE DUE shown above.

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III. All communications regarding this application must give application number and batch number. Please direct all communications prior to issuance to Box ISSUE FEE unless advised to the contrary.

IMPORTANT REMINDER: Utility patents issuing on applications filed on or after Dec. 12, 1980 may require payment of maintenance fees. It is patentee's responsibility to ensure timely payment of maintenance fees when due.

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Complete and mail this form, together with *[Signature]* the fees, to: Box ISSUE FEE
Assistant Commissioner for Patents
Washington, D.C. 20231

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SL/SD

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CURRENT CORRESPONDENCE ADDRESS (Note: Legibly mark-up with any corrections or use Block 1)

PTO 85B (Rev. 10-96) 2000
MAY 1996
U.S. PATENT & TRADEMARK OFFICE
110 MARSHALL ST., STOP A-2
WASH. D.C. 20231-3700

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Certificate of Mailing

I hereby certify that this Issue Fee Transmittal is being deposited with the United States Postal Service with sufficient postage for first class mail in an envelope addressed to the Box Issue Fee address above on the date indicated below.

Susan K. Naughton (Depositor's name)
Susan K. Naughton (Signature)
8-26-98 (Date)

APPLICATION NO.	FILING DATE	TOTAL CLAIMS	EXAMINER AND GROUP ART UNIT	DATE MAILED
10/177,129	07/09/96	020	BRITTON, H	2713 06/03/96
First Named Applicant	JOHN S.			

TITLE OF INVENTION: A DIGITAL MONITORING SYSTEM WITH IMAGE MEMORY AND CORRELATION

ATTY'S DOCKET NO.	CLASS-SUBCLASS	BATCH NO.	APPLN. TYPE	SMALL ENTITY	FEES DUE	DATE DUE
10/177,129	346-140,006	E09	UTILITY	YEE	\$660.00	09/03/96

1. Change of correspondence address or indication of "Fee Address" (37 CFR 1.363). Use of PTO form(s) and Customer Number are recommended, but not required.
- Change of correspondence address (or Change of Correspondence Address form PTO/SB/122) attached.
- "Fee Address" indication (or "Fee Address" Indication form PTO/SB/47) attached.

2. For printing on the patent front page, list (1) the names of up to 3 registered patent attorneys or agents OR, alternatively, (2) the name of a single firm (having as a member a registered attorney or agent) and the names of up to 2 registered patent attorneys or agents. If no name is listed, no name will be printed.

- 1 PEARNE, GORDON,
2 MCCOY & GRANGER LLP
3 _____

3. ASSIGNEE NAME AND RESIDENCE DATA TO BE PRINTED ON THE PATENT (print or type)
PLEASE NOTE: Unless an assignee is identified below, no assignee data will appear on the patent. Inclusion of assignee data is only appropriate when an assignment has been previously submitted to the PTO or is being submitted under separate cover. Completion of this form is NOT a substitute for filing an assignment.

(A) NAME OF ASSIGNEE

(B) RESIDENCE: (CITY & STATE OR COUNTRY)

Please check the appropriate assignee category indicated below (will not be printed on the patent)

individual corporation or other private group entity government

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Issue Fee

Advance Order - # of Copies 10

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Issue Fee

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The COMMISSIONER OF PATENTS AND TRADEMARKS is requested to apply the Issue Fee to the application identified above.

(Authorized Signature)

Michael W. Garvey, REG. No. 35878

(Date)

8/20/98

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#8

B

PATENT

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Applicant: John P. Adrian
Serial No.: 08/677,100 Art Unit: 2713
Filed: July 9, 1996
Title: "FACILITY MONITORING SYSTEM WITH IMAGE MEMORY AND CORRELATION"
Examiner: Howard W. Britton
Batch No.: E 89
Docket No.: 29520

L E T T E R

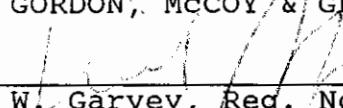
Assistant Commissioner for Patents
Washington, D.C. 20231

Attention: Official Draftsman

Sir:

Enclosed herewith are 2 (two) sheets of formal drawings for filing in the above-identified application. We have received the "Notice of Allowance and Issue Fee Due" which was mailed from the U.S. Patent and Trademark Office on June 5, 1998.

Respectfully submitted,
PEARNE, GORDON, MCCOY & GRANGER

By: 
Michael W. Garvey, Reg. No. 35878

1200 Leader Building
Cleveland, Ohio 44114
(216) 579-1700

June 29, 1998

I hereby certify that this correspondence is being deposited with the United States Postal Service as first class mail in an envelope addressed to: Assistant Commissioner for Patents, Washington, D.C. 20231 on the date indicated below.

Michael W. Garvey
Name of Attorney for Applicant(s)
6-29-98
Date 
Signature of Attorney
A000104

5831669

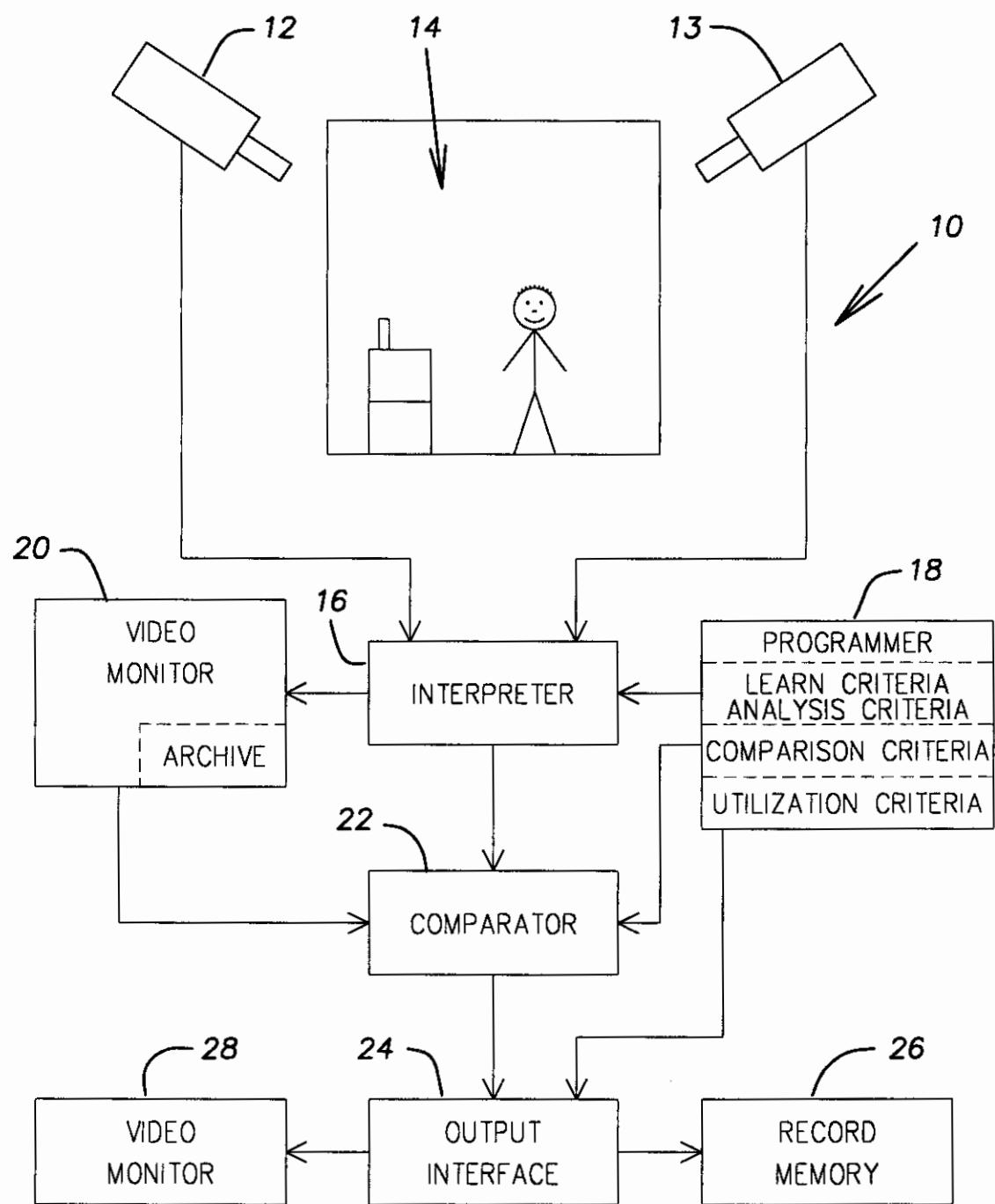


FIG. 1

A000105

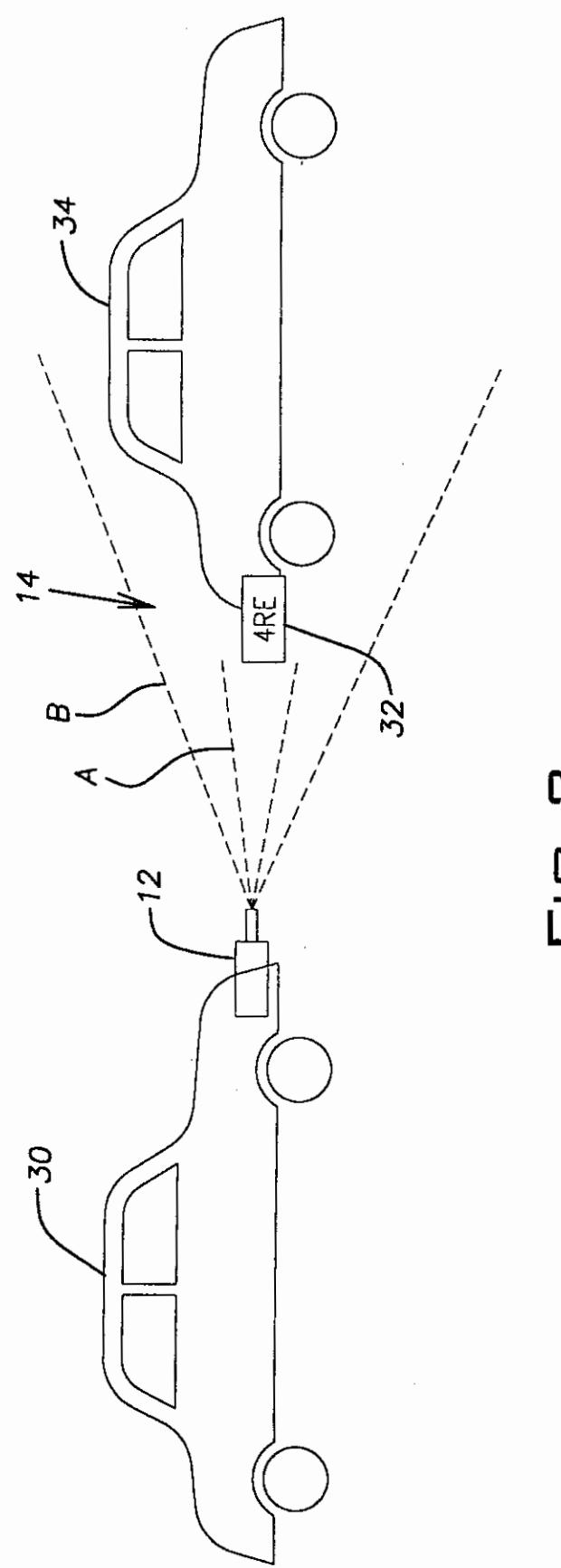


FIG. 2

A000106

The
United
States
of
America



PTO UTILITY GRANT

Paper Number 9

The Commissioner of Patents
and Trademarks

Has received an application for a patent for a new and useful invention. The title and description of the invention are enclosed. The requirements of law have been complied with, and it has been determined that a patent on the invention shall be granted under the law.

Therefore, this

United States Patent

Grants to the person(s) having title to this patent the right to exclude others from making, using, offering for sale, or selling the invention throughout the United States of America or importing the invention into the United States of America for the term set forth below, subject to the payment of maintenance fees as provided by law.

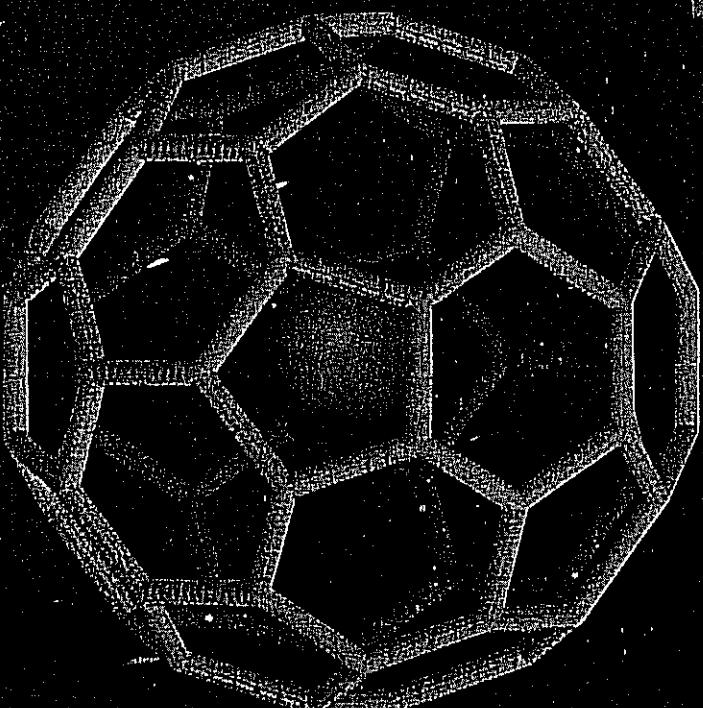
If this application was filed prior to June 8, 1995, the term of this patent is the longer of seventeen years from the date of grant of this patent or twenty years from the earliest effective U.S. filing date of the application, subject to any statutory extension.

If this application was filed on or after June 8, 1995, the term of this patent is twenty years from the U.S. filing date, subject to an statutory extension. If the application contains a specific reference to an earlier filed application or applications under 35 U.S.C. 120, 121 or 365(c), the term of the patent is twenty years from the date on which the earliest application was filed, subject to any statutory extension.

Bruce Lehman
Commissioner of Patents and Trademarks
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Sixth Edition

A000108

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A000109

On the cover: Representation of a fullerene molecule with a noble gas atom trapped inside. At the Permian-Triassic sedimentary boundary the noble gases helium and argon have been found trapped inside fullerenes. They exhibit isotope ratios quite similar to those found in meteorites, suggesting that a fireball meteorite or asteroid exploded when it hit the Earth, causing major changes in the environment. (Image copyright © Dr. Luann Becker. Reproduced with permission.)

Over the six editions of the Dictionary, material has been drawn from the following references: G. M. Garrity et al., *Taxonomic Outline of the Prokaryotes*, Release 2, Springer-Verlag, January 2002; D. W. Linzey, *Vertebrate Biology*, McGraw-Hill, 2001; J. A. Pechenik, *Biology of the Invertebrates*, 4th ed., McGraw-Hill, 2000; *U.S. Air Force Glossary of Standardized Terms*, AF Manual 11-1, vol. 1, 1972; F. Casey, ed., *Compilation of Terms in Information Sciences Technology*, Federal Council for Science and Technology, 1970; *Communications-Electronics Terminology*, AF Manual 11-1, vol. 3, 1970; P. W. Thrush, comp. and ed., *A Dictionary of Mining, Mineral, and Related Terms*, Bureau of Mines, 1968; *A DOD Glossary of Mapping, Charting and Geodetic Terms*, Department of Defense, 1967; J. M. Gilliland, *Solar-Terrestrial Physics: A Glossary of Terms and Abbreviations*, Royal Aircraft Establishment Technical Report 67158, 1967; W. H. Allen, ed., *Dictionary of Technical Terms for Aerospace Use*, National Aeronautics and Space Administration, 1965; *Glossary of Stress Terminology*, Office of Aerospace Research, U.S. Air Force, 1963; *Naval Dictionary of Electronic, Technical, and Imperative Terms*, Bureau of Naval Personnel, 1962; R. E. Huschke, *Glossary of Meteorology*, American Meteorological Society, 1959; *ADP Glossary*, Department of the Navy, NAVSO P-3097; *Glossary of Air Traffic Control Terms*, Federal Aviation Agency; *A Glossary of Range Terminology*, White Sands Missile Range, New Mexico, National Bureau of Standards, AD 467-424; *Nuclear Terms: A Glossary*, 2d ed., Atomic Energy Commission.

**McGRAW-HILL DICTIONARY OF SCIENTIFIC AND TECHNICAL TERMS,
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503—dc21

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A000110

melting profile [BIOCHEM] A plot of the degree of denaturation of the strands in a nucleic acid duplex in a specified time as a function of temperature. { 'melt-ing ,prō-fil }

melting rate [MET] In electric arc welding, the weight or length of electrode melted in a specified unit of time. Also known as burn-off rate; melt-off rate. { 'melt-ing ,rāt }

melting ratio [MET] The ratio of metal weight to fuel weight in a melting process. { 'melt-ing ,rā-shō }

melting temperature [BIOCHEM] The temperature at which denaturing occurs for half of the double helices of deoxyribonucleic acid. { 'melt-ing ,tem-prā-tūr }

melt instability [MECH] Instability of the plastic melt flow through a die. { 'melt,in-sta'bil-ədē }

melt loading [ORD] Process of melting solid explosive by heat and pouring into bombs, projectiles, and the like to solidify. Also known as cast loading. { 'melt,lōd-ing }

melt-off rate See melting rate. { 'melt,ōf ,rāt }

melton [TEXT] A fabric with all-wool or cotton warp and woolen weft; the face is napped carefully to raise the nap straight up, showing the weave clearly. Also known as beaver cloth; kersey. { 'mel-ton }

melt spinning [TEXT] A process by which nylon, polyester, or glass is melted to allow it to be extruded into fibers through a spinneret. { 'melt,spin-ing }

melt strength [MECH] Strength of a molten plastic. { 'melt,stregkth }

melt-through [NUCLEO] An accident in a nuclear reactor in which melting of the fuel core (meltdown) leads to runaway melting of nuclear fuel out of the bottom of the reactor, down through the concrete mat below, and into the earth. Also known as China syndrome. { 'melt,thrū }

meltwater [HYD] Water derived from melting ice or snow, especially glacier ice. { 'melt,wōd-ər }

Melusinidae [INV ZOO] A family of orthorrhaphous dipteran insects in the series Nematocera. { 'mel-u-sin-ə,dē }

Melyridae [INV ZOO] The soft-winged flower beetles, a large family of cosmopolitan coleopteran insects in the superfamily Cleroidea. { 'mē-lir-ə,dē }

member [CIV ENG] A structural unit such as a wall, column, beam, or tie, or a combination of any of these. [GEOL] A rock stratigraphic unit of subordinate rank comprising a specially developed part of a varied formation. [MATH] 1. An individual object that belongs to a set. Also known as element. 2. For an equation, the expression on either side of the equality sign. { 'mem-bər }

membership function [MATH] The characteristic function of a fuzzy set, which assigns to each element in a universal set a value between 0 and 1. { 'mem-bər,ship ,fāg-kshən }

Membracidae [INV ZOO] The treehoppers, a family of homopteran insects included in the series Auchenorrhyncha having a pronotum that extends backward over the abdomen, and a vertical upper portion of the head. { 'mem-brās-ad-ē }

membrane [BUILD] In built-up roofing, a weather-resistant (flexible or semiflexible) covering consisting of alternate layers of felt and bitumen, fabricated in a continuous covering and surfaced with aggregate or asphaltic material. [CHEM ENG] 1. The medium through which the fluid stream is passed for purposes of filtration. 2. The ion-exchange medium used in dialysis, diffusion, osmosis and reverse osmosis, and electrophoresis. [HISTOL] A thin layer of tissue surrounding a part of the body, separating adjacent cavities, lining cavities, or connecting adjacent structures. { 'mem-brān }

membrane analogy [MECH] A formal identity between the differential equation and boundary conditions for a stress function for torsion of an elastic prismatic bar, and those for the deflection of a uniformly stretched membrane with the same boundary as the cross section of the bar, subjected to a uniform pressure. { 'mem-brān ə,nāl-ə-jē }

membrane bone See dermal bone. { 'mem-brān ,bōn }

membrane carrier [CELL MOL] Any protein that facilitates the movement of small molecules across cell membranes. { 'mem-brān ,kar-ər }

membrane curling See membrane waterproofing. { 'mem-brān ,kyür-ing }

membrane distillation [CHEM ENG] A separation method that uses a nonwetting, microporous membrane, with a liquid feed phase on one side and a condensing permeate phase on

the other. Also known as membrane evaporation; thermopermeation; transmembrane distillation. { 'mem-brān ,dis-till-ā-shən }

membrane evaporation See membrane distillation. { 'mem-brān ,evap-ə-rā-shən }

membrane keyboard [COMPUT SCI] A flat keyboard, used with microcomputers and hand-held calculators, that consists of two closely spaced membranes separated by a flat sheet called a spacer with holes corresponding to the keys. { 'mem-brān ,kē-bōrd }

membrane mimetic chemistry [ORG CHEM] The study of processes and reactions that have been developed by using information obtained from biological membrane systems. { 'mem-brān mi'mētik 'kem-ə-satrē }

membrane potential [PHYSIO] A potential difference across a living cell membrane. { 'mem-brān pō-tēn-chāl }

membrane separation [CHEM ENG] The use of thin barriers (membranes) between miscible fluids for separating a mixture; a suitable driving force across the membrane, for example concentration or pressure differential, leads to preferential transport of one or more feed components. { 'mem-brān ,sep-ə-rā-shən }

membrane stress [MECH] Stress which is equivalent to the average stress across the cross section involved and normal to the reference plane. { 'mem-brān ,stres' }

membrane waterproofing [CIV ENG] Curing concrete, especially in pavements, by spraying a liquid material over the surface to form a solid, impervious layer which holds the mixing water in the concrete. Also known as membrane curing. { 'mem-brān 'wōd-ər,prōof-ing' }

membranous glomerulonephritis [MED] A type of glomerulonephritis characterized by thickening of the basement membrane due to deposition of electron-dense material. { 'mem-brā-nōs glō-mēr-yā-lō-nefrīt-əs' }

membranous labyrinth [ANAT] The membranous portion of the inner ear of vertebrates. { 'mem-brā-nōs lab-ə-rinth' }

membranous pregnancy [MED] Gestation in which there has been a rupture of the amniotic sac and the fetus is in direct contact with the wall of the uterus. { 'mem-brā-nōs 'preg-nəns' }

membranous urethra [ANAT] The part of the urethra between the two facial layers of the urogenital diaphragm. { 'mem-brā-nōs yō'rē-thrah' }

MEMC See methoxyethylmercury chloride.

memex [COMPUT SCI] A hypothetical machine described by Vannevar Bush, which would store written records so that they would be available almost instantly by merely pushing the right button for the information desired. { 'me,meks' }

memistor [ELEC] Nonmagnetic memory device consisting of a resistive substrate in an electrolyte; when used in an adaptive system, a direct-current signal removes copper from an anode and deposits it on the substrate, thus lowering the resistance of the substrate; reversal of the current reverses the process, raising the resistance of the substrate. { 'me'mis-tər' }

memomotion study [IND ENG] A technique of work measurement and methods analysis using a motion picture camera operated at less than normal camera speed. Also known as camera study; micromotion study. { 'mem-ō-mō-shən ,stud-ē' }

memory [COMPUT SCI] Any apparatus in which data may be stored and from which the same data may be retrieved; especially, the internal, high-speed, large-capacity working storage of a computer, as opposed to external devices. Also known as computer memory. [PSYCH] The recollection of past events or sensations, or the performance of previously learned skills without practice. { 'mem-rē' }

memory address register [COMPUT SCI] A special register containing the address of a word currently required. { 'mem-rē' ,ad,res ,rej-ə-star' }

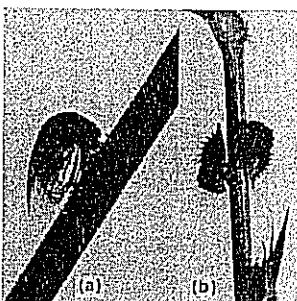
memory bank [COMPUT SCI] A physical section of a computer memory, which may be designed to handle information transfers independently of other such transfers in other such sections. { 'mem-rē ,bānk' }

memory buffer register [COMPUT SCI] A special register in which a word is stored as it is read from memory or just prior to being written into memory. { 'mem-rē' ,baf-ər ,rej-ə-star' }

memory capacity See storage capacity. { 'mem-rē' ,kā'pas-ad-ē' }

memory card [COMPUT SCI] A small card, typically with

MEMBRACIDAE



Membracids on stems. (a) Adult. (b) Nymphs. (Courtesy of C. H. Hanson)

motor grader

power-source voltage to other desired voltages or frequencies. { 'mōd·ər ,jēn·ə,mōd·ər ,sēt }

motor grader See autopatrol. { 'mōd·ər ,grād·ər }

motor learning [PSYCH] In animals or humans, learning to perform some motor task in response to a given event or stimulus. { 'mōd·ər ,lərn·iŋ }

motor meter [ENG] An integrating meter which has a rotor, one or more stators, a retarding element which makes the speed of the rotor proportional to the quantity (such as power or current) whose integral over time is being measured, and a register which counts the total number of revolutions of the rotor. { 'mōd·ər ,mēd·ər }

motor nerve [NEUROSCI] A nerve composed wholly or principally of motor fibers. { 'mōd·ər ,nōrv }

motor neuron [NEUROSCI] An efferent nerve cell. Also known as motoneuron. { 'mōd·ər ,nūrōn }

motor noise [ACOUS] The noisy sound made by an electric motor. { 'mōd·ər ,nōiz }

motor reducer [MECH ENG] Speed-reduction power transmission equipment in which the reducing gears are integral with drive motors. { 'mōd·ər ri·dū·sər }

motorship [NAV ARCH] A ship propelled by a motor which can travel on the seas; in particular, one propelled by an internal combustion engine such as a diesel engine. { 'mōd·ər,shīp }

motor speech area [ANAT] The cortical area located in the triangular and opercular portions of the inferior frontal gyrus; in right-handed people it is more developed on the left side. { 'mōd·ər ,spēch ,er·ē·ə }

motor system [PHYSIO] Any portion of the nervous system that regulates and controls the contractile activity of muscle and the secretory activity of glands. { 'mōd·ər ,sis·tēm }

motor torpedo boat [NAV ARCH] A motor boat 60 to 100 feet (18 to 30 meters) long and capable of speeds of about 60 knots (110 kilometers per hour), armed with two to four torpedo tubes, machine and antiaircraft guns, and depth charges. Also known as mosquito boat; PT boat. { 'mōd·ər tor'pēdō ,bōt }

motortruck [MECH ENG] An automotive vehicle which is used to transport freight. { 'mōd·ər,trēk }

motor unit [ANAT] The axon of an anterior horn cell, or the motor fiber of a cranial nerve, together with the striated muscle fibers innervated by its terminal branches. { 'mōd·ər ,yō·nət }

motor vehicle [MECH ENG] Any automotive vehicle that does not run on rails, and generally having rubber tires. { 'mōd·ər ,vē·ə·kəl }

mottle [MED] An effect that occurs during radiological imaging when the dose of radiation is reduced to a level where quantum effects can be observed. { 'mōld·əl }

mottled [GEOL] Of a soil, irregularly marked with spots of different colors. [GRAPHICS] Of a printed area, spotty or uneven in appearance. [PETR] Of a sedimentary rock, marked with spots of various colors. { 'mōld·əld }

mottled iron [MET] A cast iron showing gray areas that contain graphite, perlite, and sometimes ferrite, and white areas containing primarily cementite. { 'mōld·əld ,ī·rən }

mottle-leaf [PL PATH] 1. A virus disease characterized by chlorotic mottling and wrinkling of leaves. 2. A zinc-deficiency disease characterized by partial chlorosis of the leaves and stunting of the plant. { 'mōld·əl,lef }

mottramite [MINERAL] $(\text{Cu},\text{Zn})\text{Pb}(\text{VO}_4)(\text{OH})$ A mineral composed of basic lead copper zinc vanadate; it is isomorphous with descloizite. Also known as cuprodescloizite; psittacinite. { 'mōt·rāmīt }

Mott scattering [QUANT MECH] 1. The scattering of identical particles due to a Coulomb force. 2. The scattering of a relativistic electron by a Coulomb field. { 'mōt ,skad·ə·rig }

motu [GEOGR] One of a series of closely spaced coral islets separated by narrow channels; the group of islets forms a ring-shaped atoll. { 'mōt·ū }

moulage [GRAPHICS] 1. The technique of making a mold. 2. A material used to make molds; it is extremely delicate and can be used on human hair or skin, or on antiques or other objects that are too fragile to be molded in rubber, gelatin, or plaster; it is applied warm with brushes or palette knives and can be reused. { 'mōl·ēzh }

moulin [HYD] A shaft or hole in the ice of a glacier which is roughly cylindrical and nearly vertical, formed by swirling meltwater pouring down from the surface. Also known as glacial mill; glacier mill; glacier pothole; glacier well; pot-hole. { 'mōl·ēn }

moulin pothole See giant's kettle. { 'mōlēn pōtl̄,hōl̄ }

mounce [MECH] A unit of mass, equal to 25 grams. Also known as metric ounce. { 'mōns }

mound [GEOL] 1. A low, isolated, rounded natural hill, usually of earth. Also known as tuft. 2. A structure built by fossil colonial organisms. { 'mōnd̄ }

mount [ELECTROMAG] The flange or other means by which a switching tube, or tube and cavity, is connected to a waveguide. { 'mōnt̄ }

mount [ENG] 1. Structure supporting any apparatus, as a gun, searchlight, telescope, or surveying instrument. 2. To fasten an apparatus in position, such as a gun on its support. { 'mōnt̄ }

mount [ORD] To equip; to put into operation; to go into operation, as to mount an offensive. { 'mōnt̄ }

mountain [GEOGR] A feature of the earth's surface that rises high above the base and has generally steep slopes and a relatively small summit area. { 'mōnt̄·ən }

mountain and valley winds [METEOROL] A system of diurnal winds along the axis of a valley, blowing uphill and upvalley by day, and downhill and downvalley by night; they prevail mostly in calm, clear weather. { 'mōnt̄·ən an 'val·ē 'wīnz }

mountain blue [INORG CHEM] $2\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$ Ground azurite used as a paint pigment. Also known as copper blue. { 'mōnt̄·ən 'blū }

mountain breeze [METEOROL] A breeze that blows down a mountain slope due to the gravitational flow of cooled air. Also known as mountain wind. { 'mōnt̄·ən 'brēz }

mountain brown ore [GEOL] Name used in Virginia for limonite or brown iron ore. { 'mōnt̄·ən 'brōn 'ōr }

mountain butter See halotrichite. { 'mōnt̄·ən 'bōd̄·ər }

mountain chain See mountain system. { 'mōnt̄·ən ,chān }

mountain climate [CLIMATOL] Very generally, the climate of relatively high elevations; mountain climates are distinguished by the departure of their characteristics from those of surrounding lowlands, and the one common basis for this distinction is that of atmospheric rarefaction; aside from this, great variety is introduced by differences in latitude, elevation, and exposure to the sun; thus, there exists no single, clearly defined, mountain climate. Also known as highland climate. { 'mōnt̄·ən 'klī·mat }

mountain cork [MINERAL] 1. A white or gray variety of asbestos composed of thick, interwoven fibers and having a corklike weight and texture. Also known as rock cork. 2. A fibrous clay mineral, such as sepiolite. { 'mōnt̄·ən 'kōrk }

mountain crystal See rock crystal. { 'mōnt̄·ən 'krīst̄·əl }

mountain effect [ELECTROMAG] The effect of rough terrain on radio-wave propagation, causing reflections that produce errors in radio direction-finder indications. { 'mōnt̄·ən ī·fekt̄ }

mountain-gap wind [METEOROL] A local wind blowing through a gap between mountains. { 'mōnt̄·ən {gap ,wind } }

mountain glacier See alpine glacier. { 'mōnt̄·ən 'glāsh̄ər }

mountain lion See puma. { 'mōnt̄·ən ,lī·ən }

mountain mahogany See obsidian. { 'mōnt̄·ən mōhīg·ə·nē }

mountain meteorology [METEOROL] The branch of meteorology that studies the effects of mountains on the atmosphere, ranging over all scales of motion. { 'mōnt̄·ən ,mēd·ē·ə·rēl·ājē }

mountain pediment [GEOL] A plain of combined erosion and transportation at the base of and surrounding a desert-mountain range; at a distance it has the appearance of a broad triangular mass. { 'mōnt̄·ən 'ped·ə·mēnt }

mountain range [GEOGR] A succession of mountains or narrowly spaced mountain ridges closely related in position, direction, and geologic features. { 'mōnt̄·ən ,rānj }

mountain sickness [MED] A disease occurring in persons living at high altitudes when homeostatic adjustments to the lowered atmospheric oxygen tension fail or develop disproportionately. Also known as high-altitude disease; high-altitude erythrocytosis; Monge's disease; soroche. { 'mōnt̄·ən ,sik·nōs }

mountain slope [GEOGR] The inclined surface that forms a mountainside. { 'mōnt̄·ən ,slōp }

mountain soap See saponite. { 'mōnt̄·ən ,sōp }

mountain system [GEOGR] A group of mountain ranges tied together by common geological features. Also known as mountain chain. { 'mōnt̄·ən ,sis·tēm }

mountain tallow See hatchettite. { 'mōnt̄·ən ,tāl·ō }

mountain tick fever See Colorado tick fever. { 'mōnt̄·ən 'tik ·fē·vər }

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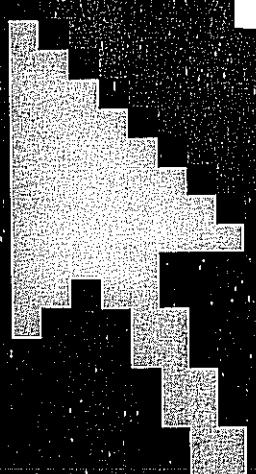
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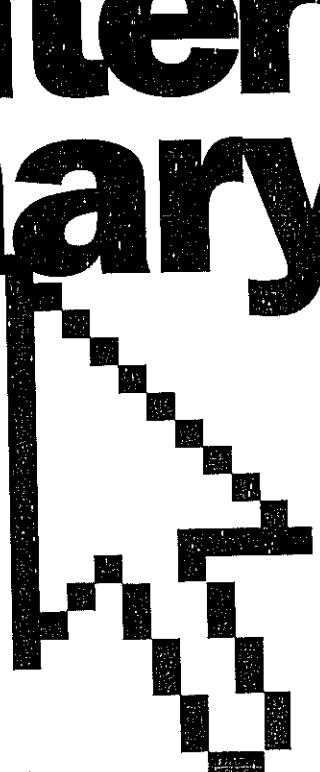
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A000115

interactive voice response *n.* A computer that operates through the telephone system, in which input commands and data are transmitted to the computer as spoken words and numbers, or tones and dial pulses generated by a telephone instrument; and output instructions and data are received from the computer as prerecorded or synthesized speech. For example, a dial-in service that provides airline flight schedules when you press certain key codes on your telephone is an interactive voice response system.
Also called IVR.

Interactive voice system *n.* *See* interactive voice response.

interapplication communication *n.* The process of one program sending messages to another program. For example, some e-mail programs allow users to click on a URL within the message. After the user clicks on the URL, browser software will automatically launch and access the URL.

interblock gap *n.* *See* inter-record gap.

Interchange File Format *n.* *See .iff.*

Interchange Format *n.* *See* Rich Text Format.

interconnect *n.* *See* System Area Network.

interface *n.* 1. The point at which a connection is made between two elements so that they can work with each other or exchange information. 2. Software that enables a program to work with the user (the user interface, which can be a command-line interface, menu-driven, or a graphical user interface), with another program such as the operating system, or with the computer's hardware. *See also* application programming interface, graphical user interface. 3. A card, plug, or other device that connects pieces of hardware with the computer so that information can be moved from place to place. For example, standardized interfaces such as RS-232-C standard and SCSI enable communications between computers and printers or disks. *See also* RS-232-C standard, SCSI.

interface adapter *n.* *See* network adapter.

interface card *n.* *See* adapter.

interference *n.* 1. Noise or other external signals that affect the performance of a communications channel. 2. Electromagnetic signals that can disturb radio or television reception. The signals can be generated naturally, as in lightning, or by electronic devices, such as computers.

Interior Gateway Protocol *n.* *See* IGP.

Interior Gateway Routing Protocol *n.* *See* IGRP.

interlace scanning *n.* A display technique designed to reduce flicker and distortions in television transmissions; also used with some PC monitors. In interlace scanning the electron beam in the television or monitor refreshes alternate sets of scan lines in successive top-to-bottom sweeps, refreshing all even lines on one pass, and all odd lines on the other. Interlaced images are not as clear as those produced by the progressive scanning typical of newer computer monitors. Interlace scanning is, however, the standard method of displaying analog broadcast television images. *Also called* interlacing. *Compare* progressive scanning.

interlacing *n.* A technique used in some raster-scan video displays in which the electron beam refreshes (updates) all odd-numbered scan lines in one vertical sweep of the screen and all even-numbered scan lines in the next sweep. Because of the screen phosphor's ability to maintain an image for a short time before fading and the tendency of the human eye to average or blend subtle differences in light intensity, the human viewer sees a complete display, but the amount of information carried by the display signal and the number of lines that must be displayed per sweep are halved. *Compare* noninterlaced.

interleave *vb.* To arrange the sectors on a hard disk in such a way that after one sector is read, the next sector in numeric sequence will arrive at the head when the computer is ready to accept it rather than before, which would make the computer wait a whole revolution of the platter for the sector to come back. Interleaving is set by the format utility that initializes a disk for use with a given computer.

interleaved memory *n.* A method of organizing the addresses in RAM memory in order to reduce wait states. In interleaved memory, adjacent locations are stored in different rows of chips so that after accessing a byte, the processor does not have to wait an entire memory cycle before accessing the next byte. *See also* access time (definition 1), wait state.

interlock *vb.* To prevent a device from acting while the current operation is in progress.

intermediate language *n.* A computer language used as an intermediate step between the original source language, usually a high-level language, and the target language, usually machine code. Some high-level compilers use assembly language as an intermediate language. *See also* compiler (definition 2), object code.

Hewlett-Packard, and IBM), formed in 1988, that promotes standards and specifications for programs operating under UNIX and licenses software (as source code) to its members. OSF's products include the Distributed Computing Environment, the graphical user interface Motif, and the OSF/1 operating system (a variant of UNIX).

OSI *n.* See ISO/OSI reference model.

OSI protocol stack *n.* The set of protocols based on—and corresponding to—the ISO/OSI reference model.

OSI reference model *n.* See ISO/OSI reference model.

OSPF *n.* Acronym for Open Shortest Path First. A routing protocol for IP networks, such as the Internet, that allows a router to calculate the shortest path to each node for sending messages. The router sends information on the nodes it is linked to, called link-state advertisements, to other routers on the network to accumulate link-state information to make its calculations. *See also* communications protocol, node (definition 2), path (definition 1), router.

OTOH *n.* Acronym for on the other hand. A short-hand expression often used in e-mail, Internet news, and discussion groups.

Outbox *n.* In many e-mail applications, the default mailbox where the program stores outgoing messages. *See also* e-mail¹ (definition 1), mailbox. *Compare* Inbox.

outdent *n.* See hanging indent.

outer join *n.* In database management, an operator in relational algebra. An outer join performs an extended join operation in which the tuples (rows) in one relation (table) that have no counterpart in the second relation appear in the resulting relation concatenated with all null values. *Compare* inner join.

outline font *n.* A font (type design) stored in a computer or printer as a set of outlines for drawing each of the alphabetic and other characters in a character set. Outline fonts are templates rather than actual patterns of dots and are scaled up or down to match a particular type size. Such fonts are most often used for printing, as is the case with most PostScript fonts on a PostScript-compatible laser printer and TrueType fonts. *Compare* bitmapped font, screen font, stroke font.

out-of-band signaling *n.* Transmission of some signals, such as control information, on frequencies out-

side of the bandwidth available for voice or data transfer on a communications channel. *Compare* in-band signaling.

output¹ *n.* The results of processing, whether sent to the screen or printer, stored on disk as a file, or sent to another computer in a network.

output² *vb.* To send out data by a computer or sound by a speaker.

output area *n.* See output buffer.

output-bound *n.* See input/output-bound.

output buffer *n.* A portion of memory set aside for temporary storage of information, leaving main memory for storage, display, printing, or transmission. *See also* buffer¹.

output channel *n.* See channel (definition 1), input/output channel.

output stream *n.* A flow of information that leaves a computer system and is associated with a particular task or destination. In programming, an output stream can be a series of characters sent from the computer's memory to a display or to a disk file. *Compare* input stream.

outsourcing *n.* The assignment of tasks to independent contractors, such as individual consultants or service bureaus. Tasks such as data entry and programming are often performed via outsourcing.

OverDrive *n.* A type of microprocessor from Intel designed to replace a computer's existing i486SX or i486DX microprocessor. The OverDrive is functionally identical to Intel's i486DX2 microprocessor, but it is an end-user product, whereas the i486DX2 is sold only to computer manufacturers who build it into their own systems. Upgrading a system with an OverDrive processor differs from system to system; and some systems might not be able to support an OverDrive processor. *See also* i486DX, i486SL, i486SX, microprocessor. *Compare* i486DX2.

overflow *n.* 1. Generally, the condition that occurs when data resulting from input or processing requires more bits than have been provided in hardware or software to store the data. Examples of overflow include a floating-point operation whose result is too large for the number of bits allowed for the exponent, a string that exceeds the bounds of the array allocated for it, and an integer operation whose result contains too many bits for the register into which it is to be stored. *See also* overflow error. *Compare* underflow.

A000117

real-time clock *n.* See *clock* (definition 2).

real-time conferencing *n.* See *teleconferencing*.

Real-Time Control Protocol *n.* A scalable transport control protocol that works with the Real-Time Protocol (RTP) to monitor real-time transmissions to multiple participants over a network—for example, during videoconferencing. The Real-Time Control Protocol, or RTCP, transmits packets of control information at regular intervals and is used to determine how well information is being delivered to recipients. *Acronym:* RTCP. *See also* Real-Time Protocol, Real-Time Streaming Protocol, Resource Reservation Setup Protocol.

real-time operating system *n.* An operating system designed or optimized for the needs of a process-control environment. *See also* real-time system.

Real-Time Protocol *n.* An Internet-standard network transport protocol used in delivering real-time data, including audio and video. The Real-Time Protocol, or RTP, works with both unicast (single sender, single recipient) and multicast (single sender, multiple recipient) services. RTP is often used in conjunction with the Real-Time Control Protocol (RTCP), which monitors delivery. *Acronym:* RTP. *See also* Real-Time Control Protocol, Real-Time Streaming Protocol, stream.

Real-Time Streaming Protocol *n.* A control protocol for the delivery of streamed multimedia data over Internet Protocol (IP) networks. The Real-Time Streaming Protocol, or RTSP, was developed by Columbia University, Progressive Networks, and Netscape and has been submitted as a proposed standard to the IETF (Internet Engineering Task Force). RTSP is designed to deliver real-time, live, or stored audio and video efficiently over a network. It can be used either for groups of recipients or for on-demand delivery to a single recipient. *Acronym:* RTSP. *See also* Advanced Streaming Format, Real-Time Protocol, Resource Reservation Setup Protocol, stream.

real-time system *n.* A computer and/or a software system that reacts to events before the events become obsolete. For example, airline collision avoidance systems must process radar input, detect a possible collision, and warn air traffic controllers or pilots while they still have time to react.

reboot *vb.* To restart a computer by reloading the operating system. *See also* boot², cold boot, warm boot.

receipt notification *n.* An e-mail feature providing feedback to the sender that a message has been received by the recipient.

receive *vb.* To accept data from an external communications system, such as a local area network (LAN) or a telephone line, and store the data as a file.

Receive Data *n.* See RXD.

rec. newsgroups *n.* Usenet newsgroups that are part of the rec. hierarchy and whose names have the prefix *rec*. These newsgroups cover topics devoted to discussions of recreational activities, hobbies, and the arts. *See also* newsgroup, traditional newsgroup hierarchy, Usenet. Compare comp. newsgroups, misc. newsgroups, news. newsgroups, sci. newsgroups, soc. newsgroups, talk. newsgroups.

recompile *vb.* To compile a program again, usually because of changes that need to be made in the source code in response to error messages generated by the compiler. *See also* compile.

record¹ *n.* A data structure that is a collection of fields (elements), each with its own name and type. Unlike an array, whose elements all represent the same type of information and are accessed using an index, the elements of a record represent different types of information and are accessed by name. A record can be accessed as a collective unit of elements, or the elements can be accessed individually. *See also* array, data structure, type¹ (definition 1).

record² *vb.* To retain information, usually in a file.

record format *n.* See record structure.

record head *n.* The device in a tape machine that places data on the tape. In some tape machines, the record head is combined with the read head.

record layout *n.* The organization of data fields within a record. *See also* record¹.

record length *n.* The amount of storage space required to contain a record, typically given in bytes. *See also* record¹.

record locking *n.* A strategy employed in distributed processing and other multiuser situations to prevent more than one user at a time from writing data to a record. *See also* record¹.

record number *n.* A unique number assigned to a record in a database in order to identify it. A record number can identify an existing record by its position (for example, the tenth record from the beginning of

a database as a key, the tenth record). *See also*

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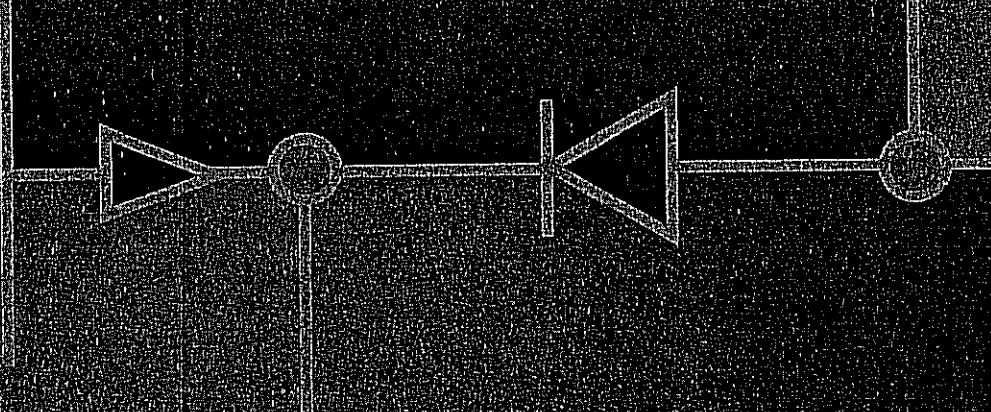
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monitor — monofilament

distinguished from multichannel (stereophonic, binaural, etc.) types. More correctly but less universally called monophonic recorder.

monitor—1. To listen to a communication service, without disturbing it, to determine its freedom from trouble or interference. 2. A device (e.g., a receiver, oscilloscope, teleprinter, etc.) used for checking signals. 3. A software package or a hardware device that can be used to measure the performance of a system or the utilization of specific devices. 4. Any device used to observe or measure a parameter. 5. Any device for listening incidentally to an audio signal that is primarily directed to some other purpose at that moment. A monitor loudspeaker is used for auditioning a recording or radio program incidentally to its commitment to tape or its broadcast. 6. The operator of a television monitoring system who selects one out of several camera images for broadcasting. 7. A TV set without a tuner used to directly display the composite video signal from a camera, videotape recorder, or special-effects generator. 8. A controller of the operation of the various programs available, the monitor can access the editor, assembler, or other programs. 9. A program that controls a computer's basic operation, telling it how and where to acquire the programs and data, where to store them, and how to run them. 10. A device for video viewing connected directly to the camera output. A true monitor does not incorporate channel selector components or audio components.

monitored fast forward—A feature in a cartridge deck whereby the playback amplifier is left on at low volume during fast forward so the user can hear the program running through at the faster speed, to spot or cue up to the desired program.

monitor head—A playback head that is separated from the record head, enabling the recordist to listen to what is coming off the tape a fraction of a second after it has been recorded and while the recording is still in progress. Without a monitor head, a tape must be recorded to its end and then rewound and replayed before the recordist can evaluate the tape. On some cassette decks with monitor capability, the monitor head is not completely separate, but is built into the same shell as the record head.

monitoring—1. Observing the characteristics of transmitted signals as they are being transmitted. 2. Listening to a communication service without disturbing it to determine its quality or freedom from trouble or interference.

monitoring amplifier—A power amplifier used primarily for evaluation and supervision of a program.

monitoring key—A key that, when operated, permits an attendant or operator to listen on a telephone circuit without causing appreciable impairment of transmission on the circuit.

monitoring radio receiver—A radio receiver for checking the operation of a transmitting station.

monitors—Programs that control the operation of an entire computer system. They often contain routines that tell the computer how to communicate with the outside world and how to allocate resources.

monitor systems—Programs that supervise other programs and keep computers functioning efficiently with a minimum of assistance from human operators.

monkey chatter—Garbled speech or music heard along with a desired program. This interference occurs when the side frequencies of an adjacent-channel station beat with the signal from the desired station.

monoboard microcomputer—See single-board microcomputer.

monobrid—A method of manufacturing an integrated circuit by using more than one monolithic chip within the same package.

monobrid circuit—An integrated circuit using a combination of monolithic and multichip techniques by means of which a number of monolithic circuits or monolithic device in combination with separate diffused or thin-film components are interconnected in a single package.

monochromatic—1. Pertaining to or consisting of a single color. 2. Radiation of a single wavelength.

monochromatic emissivity—See total emissivity.

monochromaticity—The degree of response to one color.

monochromatic light—Light consisting of just one wavelength. No light is completely monochromatic. The closest approach is particular lines in the mercury 198 spectrum excited in a discharge tube with no electrodes.

monochromatic sensitivity—The response of a device to light of a given color only.

monochromator—An instrument used to isolate narrow portions of the spectrum by making use of the dispersion of light into its component colors.

monochrome—Also called black-and-white in referring to television. 1. Having only one chromaticity—usually achromatic, or black and white and all shades of gray. 2. Black and white with all shades of gray.

monochrome channel—In a color television system, any path intended to carry the monochrome signal (although it may carry other signals also).

monochrome channel bandwidth—The bandwidth of the path that carries the monochrome signal.

monochrome signal—1. In a monochrome TV transmission, the signal wave that controls the luminance values in the picture. 2. In a color-television transmission signal wave, the portion with major control of luminance, whether displayed in color or monochrome.

monochrome television—Also called black-and-white television. Television in which the final reproduced picture is monochrome. That is, it has only shades of gray between black and white.

monochrome transmission—Also called black-and-white transmission. 1. In television, the transmission of a signal wave that represents the brightness (luminance) values in the picture, but not the color (chrominance) values.

monoclinic—A crystal structure in which two of the three axes are perpendicular to the third, but not to each other.

monocord switchboard—A local-battery telephone switchboard in which each line terminates in a single jack and plug.

monocrystal—A crystal of material that has a continuous lattice structure and orientation throughout its volume, in contrast with the multigrain structure of a polycrystal. Almost all semiconductor devices are fabricated from monocrystalline material.

monocrystalline—Material made up of a single continuous crystal.

monoergic—A type of emission in which the particles or radiations are produced with a small energy spread (i.e., a "line spectrum").

monofier—A complete master oscillator and power amplifier system contained in a single evacuated envelope. It is equivalent electrically to a stable low-noise oscillator, an isolator, and a two- or three-cavity klystron amplifier.

monofilament—A single-stranded filament as opposed to a braided or twisted filament. **A000122**

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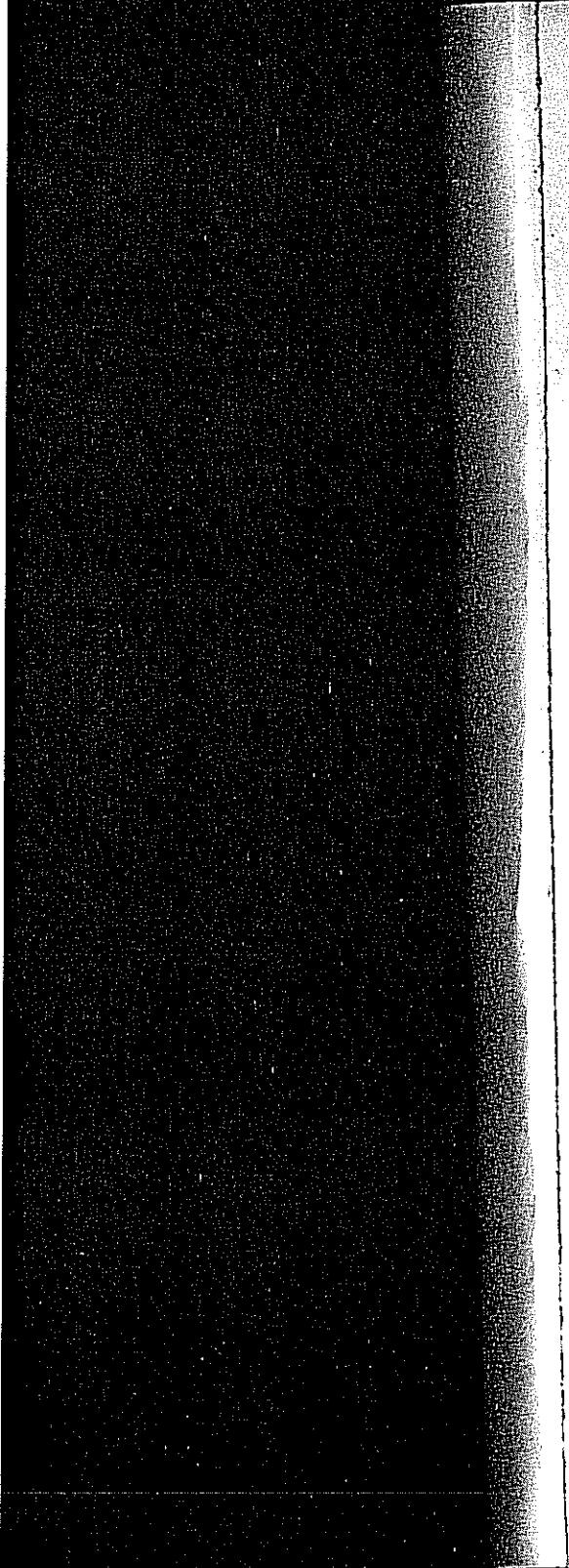
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coolant *n.* a fluid or other substance for cooling engines, etc.
cool'er *n.* 1 a container or room for keeping things cool 2 a cold, refreshing drink 3 [Slang] jail
coo-lie (*koo'li*) *n.* [Hindi *quill*, servant] an unskilled native laborer, esp. formerly, in India, China, etc.
coon (*koo'n*) *n. short for RACCOON*
coo'n'skin' *n.* the skin of a raccoon, used as a fur
coop (*koo'p*) *n.* [*< L cupa, cask*] a small pen as for poultry —*vt.* to confine as in a coop
co-op (*koo'op*) *n.* [Colloq.] a cooperative
cooper (*koo'p'er*) *n.* [see COOP] one whose work is making or repairing barrels and casks —*cooperage* ('-j') *n.*
co-operate or co-operate (*koo'op'r at'*) *vi.* -*at-ed*, -*at-ing* [*< L co-, with + opus, work*] to act or work together with another or others —*co-operation* or *co-operation* *n.*
co-op'er-a-tive or co-op'er-a-tive (-ar a tiv, -ar at'iv) *adj.* 1 cooperating 2 owned collectively by members who share in its benefits —*n.* a cooperative store, etc.
co-opt (*koo'opt', koo'ipt'*) *vt.* [*< L < co-, with + optare, choose*] 1 to appoint as an associate 2 to get (an opponent) to join one's side
co-or-di-nate or co-or-di-nate (*koo'ord'ne nit; also, for u, always, -da nät'*) *adj.* [*< L co-, with + ordo, order*] 1 of the same order or importance *coordinate clauses in a sentence* 2 of coordination or coordinates —*n.* a coordinate person or thing —*vt.* -*nat-ed*, -*nat-ing* 1 to make coordinate 2 to bring into proper order or relation; adjust —*co-or-di-na-tor* or *co-or-di-na-tor* *n.*
coordinating conjunction a conjunction connecting coordinate words, clauses, etc. (Ex.: *and*, *but*, *nor*)
co-or-di-na-tion or co-or-di-na-tion *n.* 1 a coordinating or being coordinated 2 harmonious action, as of muscles
coot (*koot*) *n.* [ME *cote*] 1 a ducklike water bird 2 [Colloq.] an eccentric
cootie (*koo'te*) *n.* [Slang] a louse
cop (*kop*) *vt.* *copped*, *cop'ping* [*prob. < L capere, take*] 1 to seize, steal, etc. —*n.* [Slang] a policeman —*cop out* [Slang] 1 to renege 2 to give up; quit
co-part-ner (*koo'part'ner, koo'part'-r*) *n.* a partner
cope¹ (*kop*) *vi.* *coped*, *cop'ing* [*< OFr coper, to strike*] 1 to fight or contend (*with*) successfully 2 to deal with problems, etc.
cope² (*kop*) *n.* [*< LL *cappa**] 1 a large, capelike vestment worn by priests 2 any cover like this
cop'er (*küp'är*) *n.* 1 one who copies 2 a duplicating machine
co-pil'ot (*kö'pil'at*) *n.* the assistant pilot of an airplane
cop-ing (*kö'pig*) *n.* [*< core*'] the top layer of a masonry wall
co-pli-ous (*kö'plüs* as) *adj.* [*< L copia, abundance*] plentiful; abundant —*co-pli-ously* *adv.* —*co-pli-ous-ness* *n.*
cop'-out' *n.* [Slang] a copming out, as by reneging or quitting
cop-per (*küp'är*) *n.* [*< LL *cyprium**] 1 a reddish-brown, ductile, metallic chemical element 2 a reddish brown —*adj.* 1 of copper 2 reddish-brown —*cop'per-ty* *adj.*
cop'per-head *n.* a poisonous North American snake
co-pra (*kü'pra, kö'*) *n.* [Port < Hindi *khunprā*] dried coconut meat, the source of coconut oil
copse (*küp'se*) *n.* [*< OFr coper, to strike*] a thicket of small trees or shrubs. Also *cop-pice* (*küp'is*)
cop-ter (*küp'tär*) *n. short for HELICOPTER*
copu-la (*küp'yoo la*) *n., pl. -las* [*L, a link*] a verb form, as of *be, seem, appear*, etc., that links a subject with a predicate —*copu-la-tive* (-lät'iv) *adj.*
copu-late (*küp'yoo lat'*) *vi.* -*lated*, -*lat-ing* [*< L co-, together + aperere, to join*] to have sexual intercourse —*copu-la-tion* *n.*
copy (*küp'tä*) *n., pl. -ies* [*< L *copia*, plenty*] 1 a thing made just like another 2 any of a number of books, magazines, etc. having the same contents 3

matter to be set in type 4 the words of an advertisement —*vt.* *vi.* *cop'ied*, *copy-ing* 1 to make a copy of 2 to imitate —*cop'y-ist* *n.*

cop'y-cat' (-kat') *n.* an imitator

cop'y-right' n. the exclusive right to the publication, sale, etc. of a literary or artistic work —*vt.* to protect (a book, etc.) by copyright

cop'y-writ'er n. a writer of copy, esp. for advertisements

co-quette (*koo'ket'*) *n.* [Fr] a girl or woman flirt —*vi.* -*quet'ed*, -*quet'ting* to flirt —*co-quet'tish* *adj.*

cor- prefix com- Used before *r*

coral (*kör'äl*) *n.* [*< Gr *korallion**] 1 the hard skeleton secreted by certain marine polyps; reefs and atolls of coral occur in tropical seas 2 a piece of coral 3 a yellowish red —*adj.* of coral

coral snake a small, poisonous snake marked with coral, yellow, and black bands

cor-beL (*kör'bal*) *n.* [*< L *corvus*, raven*] a piece of stone, wood, etc. projecting from a wall and supporting a cornice, arch, etc.

cord (*kör'd*) *n.* [*< Gr *chordē**] 1 a thick string 2 a measure of wood cut for fuel (128 cu. ft.) 3 a rib on the surface of a fabric 4 ribbed cloth 5 [*pl.*] corduroy trousers 6 *Anat.* any part like a cord 7 *Elec.* a slender cable —*vt.* to provide with cords

cord-age' (-ij') *n.* cords and ropes

cordial (*kör'däl*) *adj.* [*< L *cor*, heart*] warm; hearty; sincere —*n.* a liqueur —*cordial'ly* (-lé'äl'ē) *adv.* —*cordially* *adv.*

cordil-lera (*kör'dil yér'a, -da lér'a*) *n.* [Sp < L *chorda*, a cord] a system or chain of mountains

cord-ite (*kör'dit'*) *n.* [*< cord*; it is stringy] a smokeless explosive made of nitroglycerin, etc.

cord-less (*kör'dlis*) *adj.* operated by batteries, as an electric shaver

cordon (*kör'dən*) *n.* [*see CORD*] 1 a line or circle of police, troops, etc. guarding an area 2 a cord or braid worn as a decoration —*vt.* to encircle with a cordon

cor-do-van (*kör'dō van*) *n.* [*after Córdoba, Spain*] a soft, colored leather

cordu-roy (*kör'dü röy*) *n.* [*prob. < cord + obs. durio*, a coarse fabric] a heavy, ribbed cotton fabric

core (*kör*) *n.* [*prob. < L *cor*, heart*] 1 the central part of an apple, pear, etc. 2 the central part of anything 3 the most important part —*vt.* cored, *cor-ing* to remove the core of

cor-respond-ent (*kör'ri spän'dənt*) *n.* [*co- + RESPONDENT*] *Law* a person charged with having committed adultery with the wife or husband from whom a divorce is being sought

cor-i-an-der (*kör'e ar'där*) *n.* [*< Gr *korandron**] an annual herb with strong-smelling, seedlike fruit used as a flavoring

cork (*körk*) *n.* [*ult. < L *quercus*, oak*] 1 the light, thick, elastic outer bark of an oak tree (cork oak) 2 a piece of cork; esp., a stopper for a bottle, etc. 3 any stopper —*adj.* of cork —*vt.* to stop with a cork

cork-screw' *n.* a spiral-shaped device for pulling corks out of bottles —*adj.* spiral —*vt.*, *vt.* to twist

corn (*körm*) *n.* [*< Gr *hormas*, a log*] a fleshy, underground stem of certain plants, as the gladiolus

cor-mo-rant (*kör'mo ront*) *n.* [*< L *corvus*, raven + *marinus, marin**] a large, voracious sea bird

corn¹ (*körn*) *n.* [*OE*] 1 a small, hard seed, esp. of a cereal grass 2 a) an American cereal plant, with kernels growing in rows along a woody, husk-enclosed corncob; maize b) the kernels 3 [*Brit.*] grain, esp. wheat 4 the leading cereal crop in a place 5 [Colloq.] ideas, humor, etc. regarded as old-fashioned, trite, etc. —*vt.* to pickle (meat, etc.) in brine

corn² (*körn*) *n.* [*< L *cornu*, horn*] a hard, thick, painful growth of skin, esp. on a toe

corn-ball' (-ból') *adj.* [*corn¹, n. 5 + (SCREW)BALL*] [Slang] corny

corn bread bread made with cornmeal

cor-neja (*kör'nē ä*) *n.* [*< L *cornu*, horn*] the transparent outer coat of the eyeball —*cor-neal* *adj.*

cor-ner (*kör'nor*) *n.* [*< L *cornu*, horn*] 1 the point or place where lines or surfaces join and form an angle 2 the angle formed 3 any of the angles formed at a street intersection 4 a remote, secluded place 5

cringe (*kriنج*) *vi.*, *vt.* [*ME cringen*] to make or become crimson to fall (in battle) *1* to draw back, crouch, etc., as when afraid; cower *2* to fawn

crinkle (*kriŋ'kəl*) *vi.*, *vt.* -kled, -kling [*see prec.*] *1* to wrinkle *2* to rustle, as crushed paper —*crinkly*, *-kler*, *-kli-est*, *adj.*

crinoline (*kriň'lin*) *n.* [*Fr < It < crino, horsehair + lino, linen*] *1* a coarse, stiff cloth used as a lining in garments *2* hoop skirt

cripple (*krip'əl*) *n.* [*< OE crepan*] to creep *1* one who is lame or otherwise disabled —*vt.* -pled, -pling *1* to lame *2* to disable; impair

crisis (*kri'sis*) *n.*, *pl.* -ses' (-sēz') [*L < Gr krinein, to separate*] *1* the turning point of a disease for better or worse *2* a decisive or crucial time, stage, or event

crisp (*krisp*) *adj.* [*< L crispus, curly*] *1* brittle; easily crumpled *2* fresh and firm *3* sharp and clear *4* fresh and invigorating *5* curled and wiry Also *crisply* —*crispy* *adv.* —*crispness* *n.*

cross-cross (*kriš'krōs'*) *n.* [*ME Christcross, Christ's cross*] *a mark or pattern made of crossed lines* —*adj.* marked by crossing lines —*vt.* to mark with crossing lines —*vi.* to move crosswise —*adv.* *1* crosswise *2* awry

critic-er-on (*krit'ikən*) *n.*, *pl.* -ria (-rēə) or -tions [*< Gr kritis, judge*] *1* a standard, rule, or test by which something can be judged

critic (*krit'ik*) *n.* [*< Gr krinein, discern*] *1* one who judges books, music, plays, etc., as for a newspaper *2* one who finds fault

crit'-ical (-i'kal) *adj.* *1* tending to find fault *2* of critics or criticism *3* of or forming a crisis; decisive

crit'-icism (-iz'm) *n.* *1* the act of making judgments, esp. of literary or artistic work *2* a review, article, etc. expressing such judgment *3* censure *4* the art, principles, or methods of critics

crit'-icize (-i siz') *vt.*, *vi.* -cized', -ciz'ing *1* to analyze and judge as a critic *2* to find fault (with) —*crit'-icizable adj.* —*crit'-icizer n.*

critique (*krit'ik*) *n.* [*Fr*] *a critical analysis or review* —*vt.*, *vi.* -qued', -quing to criticize (a subject, art work, etc.)

critter (*krit'or*) *n.* *dial. var. of CREATURE*

croak (*kroák*) *vi.* [*echoic*] *1* to make a deep, hoarse sound, as a frog does *2* [Slang] to die —*vt.* to utter in deep, hoarse tones —*n.* a croaking sound

crochet (*kro'shət*) *n.* [*Fr, small hook*] *needlework done with one hooked needle* —*vt.*, *vi.* -cheted' (-shēt'), -chet'ing to do, or make by, crochet —*crochet'er* (-sha'or) *n.*

crock (*krok*) *n.* [*OE crocca*] *an earthenware pot or jar* —*crock'ery n.*

crocked (*krik't*) *adj.* [*< crock, to disable*] *[Slang]* drunk

croco-dile (*krok'dil*) *n.* [*< Gr krokodilos, lizard*] *a large, lizardlike reptile of tropical streams, having a long, narrow head with massive jaws*

crocus (*kro'kos*) *n.*, *pl.* -cuses or -ci' (-si') [*< Gr krokos, saffron*] *a spring-blooming plant of the iris family, with fleshy underground stems and a yellow, purple, or white flower*

Cro-e-sus (*krē'sas*) *n.* [*after Croesus, a wealthy king of ancient times*] *a very rich man*

croissant (*kroô sânt', kra sânt'*) *n.* [*Fr, crescent*] *a crescent-shaped, flaky bread roll*

Cro-Magnon (*kro mag'nən*) *adj.* [*after Cro-Magnon cave in France*] *of a Stone Age type of tall human of the European continent*

crore (*kroń*) *n.* [*< MDu kronje, old ewe*] *an ugly, withered old woman*

crooky (*kro'ne*) *n.*, *pl.* -ries [*< Gr chronas, time*] *a close friend*

crook (*kroök*) *n.* [*< ON hröhr, hook*] *1* a hooked or curved staff, etc.; hook *2* a bend or curve *3* [Colloq.] a swindler —*vt.*, *vi.* crooked (*kroök*), crook'ing to bend or curve

crooked (*kroök*; *far 2 & 3 kroök'id*) *adj.* *1* having a crook *2* not straight; bent *3* dishonest —*crook-ed-ly adv.* —*crook-ed-ness n.*

crook-neck' *n.* a squash with a long, curved neck

croon (*kroön*) *vi.*, *vt.* [*ME croonen*] to sing or hum in a low, gentle tone —*n.* a low, gentle singing or humming —*crooner n.*

crop (*krip*) *n.* [*OE croppa, a cluster*] *1* a saclike part of a bird's gullet, in which food is stored before digestion *2* any agricultural product, growing or harvested *3* the yield of any product in one season or place *4* a group *5* the handle of a whip *6* a riding whip *7* hair cut close to the head —*vt.* cropped, crop'ping *1* to cut or bite off the tops or ends of *2* to reap *3* to cut short —*crop out* (or up) to appear unexpectedly

crop-dust'ing *n.* the spraying of crops with pesticides from an airplane —*crop-dust' vt.*, *vt.*

crop-per *n.* *1* one that crops *2* a sharecropper —*come a cropper* [Colloq.] to come to ruin; fail

croquet (*kro'kēt*) *n.* [*Fr, dial. form of crochet, small hook*] *an outdoor game in which the players use mallets to drive a ball through hoops in the ground*

croquette (*kro'ket*) *n.* [*Fr < croquer, to crunch*] *a small mass of meat, fish, etc. fried in deep fat*

cro-sier (*kro'zher*) *n.* [*< OFr croce*] *the staff carried by a bishop or abbot*

cross (*kros*) *n.* [*< L crux*] *1* an upright post with a bar across it, on which the ancient Romans executed people *2* a representation of this as a symbol of the crucifixion of Jesus, hence of Christianity *3* any trouble or affliction *4* any design or mark made by two intersecting lines, bars, etc. *5* a crossing of varieties or breeds —*vt.*, *vi.* *1* to make the sign of the cross (upon) *2* to place or lie across or crosswise *3* to intersect *4* to draw a line or lines across *5* to go or extend across *6* to meet and pass (each other) *7* to oppose *8* to interbreed (animals or plants) —*adj.* *1* lying or passing across *2* contrary; opposed *3* cranky; irritable *4* of mixed variety or breed —*cross off* (or out) to cancel as by drawing lines across —*cross one's mind* to come suddenly to one's mind —*cross one's path* to meet one —*cross'ly adv.*

cross-bar *n.* a bar, line, or stripe placed crosswise

cross-beam *n.* any transverse beam in a structure

cross-bones' *n.* a representation of two bones placed across each other, under a skull, used to symbolize death

crossbow (-bō) *n.* a weapon consisting of a bow set transversely on a wooden stock —*crossbowman*, *pl.* -men, *n.*

cross-breed' *vt.*, *vi.* -bred' (-bred'), -breeding hybridize —*n.* HYBRID (sense 1)

cross'-country *adj.*, *adv.* across open country or fields, as a race

cross'-cut *saw* a saw designed to cut across the grain of wood

cross'-exam'-line (-ig zam'in) *vt.*, *vi.* -ined', -ining *Law* to question (a witness called by the opposing side) to challenge the witness's previous testimony —*cross-exam'ina-tion n.*

cross'-eye' *n.* an abnormal condition in which the eyes are turned toward each other —*cross'-eyed' adj.*

cross-hatch' (-hach') *vt.*, *vi.* to shade (a drawing) with two sets of parallel lines that cross each other

cross-ing *n.* *1* the act of passing across, interbreeding, etc. *2* a intersection, as of streets *3* a place where a street, etc. may be crossed

cross-piece' *n.* a piece lying across another

cross-pollinate *vt.*, *vi.* -nat-ed, -nat-ing to transfer pollen from the anther of (a flower) to the stigma of (a genetically different flower) —*cross-pollina-tion n.*

cross'-pur-pose *n.* a contrary purpose —*at cross-purposes* having a misunderstanding as to each other's purposes

cross-refer-ence *n.* a reference from one part of a book, etc., to another —*vt.* -fenced, -fencing to provide (an index, etc.) with cross-references —*cross-refer' vt.*, *vt.*

cross-road' *n.* *1* a road that crosses another *2* [usually pl., often with sing. *v.*] *a* the place where roads

motion picture FILM (n. 4)

motion sickness nausea, vomiting, etc. caused by the motion of a car, boat, etc.

motivate (mōt'ivāt') *vt.* -vat'ed, -vat'ing to provide with, or affect as, a motive; incite —*motiv'a-tion* *n.*

motive (mōt'iv) *n.* [L *movere*, to move] 1 an inner drive, impulse, etc. that causes one to act; incentive 2 MOTIF (sense 1) —*adj.* of or causing motion

motive (mōt'iv) combining form moving, of motion [automotive]

motley (mōt'lē) *adj.* 1 < ? 1 of many colors 2 of many different or clashing elements *fa motley* group; **motor-cross** (mōt'kō krōs') *n.* [Fr] a cross-country race for lightweight motorcycles

motor (mōt'ər) *n.* [L < *movere*, to move] 1 anything that produces motion 2 an engine; esp., an internal-combustion engine 3 a machine for converting electric energy into mechanical energy —*adj.* producing motion 2 of or powered by a motor 3 of, by, or for motor vehicles 4 of or involving muscular movements —*vi.* to travel by automobile

motor-bike *n.* [Colloq.] 1 a motor-driven bicycle 2 light motorcycle

motor-boat *n.* a motor-driven boat, esp. a small one

motor-cade (-kād') *n.* [MOTOR + -CADE] an automobile procession

motor-car *n.* an automobile

motor-cycle (-sī'kəl) *n.* a two-wheeled vehicle propelled by an internal-combustion engine —*motorcyclist* *n.*

motor home a motor vehicle with a truck chassis, outfitted as a traveling home

motorist (mōt'ər ist) *n.* one who drives an automobile or travels by automobile

motorize (-iz') *vt.* -ized, -iz'ing to equip with a motor or with motor-driven vehicles —*motoriza-tion* *n.*

motor-man (-man) *n.*, *pl.* -men one who drives an electric streetcar or electric locomotive

motor vehicle an automotive vehicle, esp. an automobile, truck, or bus

motif (mōt'if) *vt.* -fled, -filing [*< MOTLEY*] to mark with blotches, etc. of different colors —*motif'd* *adj.*

motto (mōt'ō) *n.*, *pl.* -toes or -tos [It, a word] a word or saying that expresses the goals, ideals, etc., of a nation

mould (mōld') *n.*, *vt.*, *vi.* chiefly Brit., etc. *sp. of MOLD*, MOLD², MOLN³

moulding *n.* chiefly Brit., etc. *sp. of MOLDING*

mouldy (mōld'ē) *adj.* chiefly Brit., etc. *sp. of MOLDY*

moult (mōlt) *vi.* chiefly Brit. *sp. of molt*

mound (mōnd) *n.* [< ? MDu *mond*, protection] 1 a heap or bank of earth, sand, etc. —*vt.* to heap up

mount¹ (mount) *n.* [< L *mons*] a mountain

mount² (mount) *vi.* [< L *mons*, mountain] 1 to climb; ascend 2 to climb up on something, as a horse 3 to increase in amount. —*vt.* 1 to go up; ascend [to mount stairs] 2 to get up on (a horse, platform, etc.) 3 to provide with horses (*mounted police*) 4 to place or fix (a jewel, picture, etc.) on or in the proper support, backing, etc. 5 to arrange (a dead animal, etc.) for exhibition 6 to place (a gun) into proper position for use 7 to prepare for and undertake (an expedition, etc.) —*n.* 1 a mounting 2 a horse, etc. for riding 3 the support, setting, etc. on or in which a thing is mounted

mountain (mount'n) *n.* [ult. < L *mons*] 1 a natural raised part of the earth, larger than a hill 2 a large pile, amount, etc. —*adj.* of or in mountains

mountain-eer (-ir') *n.* 1 one who lives in a mountainous region 2 a mountain climber

mountain goat a long-haired, goatlike antelope of the Rocky Mountains

mountain lion COUGAR

mountainous *adj.* 1 full of mountains 2 like a mountain; esp., huge

mountain sickness weakness, nausea, etc. caused by thin air at high altitudes

mountebank (mount'ə bānk') *n.* [< It *montare*, to mount + *in*, on + *banc*, bench] a charlatan or quack

mounting *n.* something serving as a backing, support, setting, etc.

mourn (mōrn) *vt.* [OE *murnan*] 1 to feel or express sorrow for (something regrettable) 2 to grieve for (someone who has died) —*mourn'er* *n.*

mourn'ful *adj.* 1 feeling or expressing grief or sorrow 2 causing sorrow

mourn'ing *n.* 1 the expression of grief, esp. at someone's death 2 black clothes, etc., worn as such an expression 3 the period during which one mourns

mouse (mōus) [*for v. also mouz*] *n.*, *pl.* mice [OE *mus*] 1 any of many small rodents, esp. a species that commonly infests buildings 2 timid person 3 [Slang] a black eye 4 a hand-held device for controlling the video display of a computer —*vi.* moused, mous'ing to hunt mice

mousse (mōos) *n.* [Fr, foam] 1 a light, chilled dessert made with egg white, whipped cream, etc. 2 an aerosol foam used to keep hair in place, etc.

mous-tache (mōs'tash') *n.* var. of MUSTACHE

mousy (mōs'ē, mōz'-ē) *adj.* -shēr, -shēst of or like a mouse; specif., quiet, timid, drab, etc. Also mous'ey —*mous'y-ness* *n.*

mouth (mouth) [*for v. mouth*] *n.*, *pl.* mouths (mouths) [OE *muth*] 1 the opening in the head through which food is taken in and sounds are made 2 any opening regarded as like this (the mouth of a jar, river, etc.) —*vt.* 1 to say, esp. insincerely 2 to form (a word) with the mouth silently —down in (or at) the mouth [Colloq.] unhappy —mouth off [Slang] to talk loudly, impudently, etc.

mouth'ful *n.*, *pl.* -fuls' 1 as much as the mouth can hold 2 as much as is usually taken into the mouth 3 a small amount 4 [Slang] a pertinent remark; chiefly in say a mouthful

mouth organ HARMONICA

mouth'piece *n.* 1 a part, as of a musical instrument, held in or to the mouth 2 a person, pernicious, etc. which expresses the views as of a group

mouth'wash *n.* a flavored, often antiseptic liquid for rinsing the mouth

mouth'wa-ter-ing (-wōt'ər īg) *adj.* appetizing; tasty

mouth'y *adj.* -shēr, -shēst talkative, esp. in a bombastic or rude way —*mouth'iness* *n.*

mou-ton (mōt'ān) *n.* [Fr, sheep] lambkin or sheepskin made to resemble beaver, seal, etc.

movable (mōv'əb'l) *adj.* that can be moved from one place to another —*n.* 1 something movable 2 Law personal property, esp. furniture; usually used in pl. Also move'able

move (mōv') *vt.* moved, mov'ing [*< L movere*] 1 to change the place or position of 2 to set or keep in motion 3 to cause (to do, say, etc.) 4 to arouse the emotions, etc. of 5 to propose formally, as in a meeting —*vi.* 1 to change place or position 2 to change one's residence 3 to be active 4 to make progress 5 to take action 6 to be, or be set, in motion 7 to make a formal application (for) 8 to evacuate; said of the bowels 9 to be sold; said of goods —*n.* 1 act of moving 2 an action toward some goal 3 a change of residence 4 Chess, Checkers, etc. the act of moving a piece, or one's turn to move —move up to promote or be promoted —on the move [Colloq.] moving about from place to place

move'ment *n.* 1 a moving or manner of moving 2 an evacuation (of the bowels) 3 a change in the location of troops, etc. 4 organized action by people working toward a goal 5 the moving parts of a mechanism, as of a clock 6 *Musical* a) a principal division of a symphony, etc. b) rhythm

mov'er *n.* one that moves; specif., one whose work is moving furniture, etc. for those changing residence

movie (mōv'ē) *n.* [*< moving picture*] FILM (n. 4) —*the movies* 1 the film industry 2 a showing of a film

mow¹ (mō) *vt.*, *vi.* mowed, mowed or mown (mōn), mowing [OE *mawan*] to cut down (grass, etc.) from (a lawn, etc.) —mow down 1 to cause to fall like cut

new plant can grow *b*) such seeds collectively 2 the source of anything 3 [Archaic] descendants; posterity 4 sperm or semen —*vt.* 1 to plant with seeds 2 to remove the seeds from 3 to distribute (contestants in a tournament) so that the best players are not matched in early rounds —*vi.* to produce seed —*go (or run) to seed* 1 to shed seeds after flowering 2 to deteriorate, weaken, etc. —*seed'er n.* —*seed'less adj.*

seed'ling (-lɪŋ) n. 1 a plant grown from a seed 2 a young tree

seed money money to begin a long-term project or get more funds for it

seed vessel any dry, hollow fruit containing seeds

Also *seed'case' n.*

seed'ly adj. -ier, -i-est 1 full of seed 2 gone to seed 3 shabby, rundown, etc. —*seed'li-ness n.*

seek (sék) vt. sought, seek'ing [OE *secan*] 1 to try to find; search for 2 to try to get 3 to aim at 4 to try; attempt [*to seek to please*] —*seek'er n.*

seem (sém) vi. [prob. < ON *sama*, conform to] 1 to appear to be [*to seem happy*] 2 to appear /seems to know/ 3 to have the impression (with an infinitive) [*I seem to have lost it*]

seem'ing adj. that seems real, true, etc.; apparent —*seem'ingly adv.*

seem'ly adj. -ier, -i-est suitable, proper, etc. —*seem'li-ness n.*

seen (sén) vt., vi., pp. of SEE¹

seep (sep) vt. [OE *sipian*, to soak] to leak through small openings; ooze —*seep'age (-i-) n.*

seer (sir) n. one who supposedly foretells the future —*seer'ess n.fem.*

seer-sucker (sir'suk'ər) n. [< Pers *shir u shakar*, lit., milk and sugar] a crinkled fabric of linen, cotton, etc.

see-saw (sé'só) n. [< SAW¹] 1 a plank balanced at the middle on which children at play, riding the ends, rise and fall alternately 2 any up-and-down or back-and-forth motion or change —*vt.*, *vi.* to move up and down or back and forth

seethe (séth) vi. seethed, seeth'ing 1 to boil, surge, or bubble 2 to be violently agitated

seg-ment (seg'ment; for v., -ment) n. [< L *secare*, to cut] any of the parts into which something is separated; section —*vt.*, *vi.* to divide into segments —*seg'men-ta'tion n.*

seg-re-gate (seg're gāt') vt. -gated, -gating [< L *se-, apart + grex*, a flock] to set apart from others; specific, to impose racial segregation on

seg're-gation n. the policy of compelling racial groups to live apart and use separate schools, facilities, etc. —*seg're-gation-ist n.*

se-que (segwā, sāgwā) vi. -qued, -gue-ing [It, (it follows) < L *sequi*, to follow] to continue without break (*to or into the next part*) —*n.*, an immediate transition to the next part

sei-nior (sān'yōr, sān yōr) n. [< OFr *seignor* < L *senior*] a feudal lord

seine (sāp) n. [< Gr *sagēne*] a large fishing net weighted along the bottom —*vt.*, *vi.* seined, seining to fish with a seine —*sein'er n.*

seis-mic (sīz'mik) adj. [< Gr *seismos*, earthquake] of or caused by an earthquake —*seis'mi-cally adv.*

seis'mo-graph' (-mō graf') n. [see prec. & -GRAPH¹] an instrument that records the intensity and duration of earthquakes —*seis'mo-graph'ic adj.*

seis-mol-o-gy (sīz mōl'ō jē, sīz-) n. [see SEISMIC & -LOGY¹] the science dealing with earthquakes —*seis'mo-log'ic (-mō lōj'ik)* or *seis'mo-log'i-cal adj.*

seize (sīz) vt. seized, seiz'ing [< ML *sacire*] 1 *a* to take legal possession of *b* to capture; arrest 2 to take forcibly and quickly 3 to grasp suddenly 4 to attack or afflict suddenly (*seized with pain*) —*seizure (sīz'hār) n.*

sel-dom (sel'dom) adv. [OE *seldan*, strange] rarely; infrequently

se-lect (sa lekt') adj. [< L *se-, apart + legere*, to choose] 1 chosen in preference to others 2 choice;

excellent 3 careful in choosing 4 exclusive —*vt.*, *vi.* to choose or pick out —*se-select'ness n.* —*se-lec'tor n.*

selec'tion (-lek'shan) n. 1 a selecting or being selected 2 that or those selected —*se-select'ive adj.* —*se-lec'tiv'ity n.*

selec'tive service compulsory military service set by age, fitness, etc.

select'man (-mon) n., pl. -men one of a board of governing officers in most New England towns

se-le-ni-um (sā lē'nē əm) n. [ModL < Gr *selēnē*, the moon] a gray, nonmetallic chemical element: used in photoelectric devices

sel'enog-ra-phy (sēl'a nōg'rā fē) n. [< Gr *selēnē*, moon + -GRAPHY¹] the study of the physical features of the moon —*sel'enog'rāpher n.*

self (self) n., pl. selves [OE] 1 the identity, character, etc. of any person or thing 2 one's own person as distinct from all others 3 one's own welfare or interest —*pron.* [Colloq.] myself, himself, etc. /for self and wife/ —*adj.* of the same kind, color, etc. /self-trim/

self-prefix of, by, in, to, or with oneself or itself The following list includes some common compounds formed with *self-* that do not have special meanings:

self-abasement	self-improvement
self-advancement	self-incrimination
self-appointed	self-induced
self-assertion	self-indulgence
self-command	self-indulgent
self-complacent	self-inflicted
self-deceit	self-knowledge
self-deception	self-love
self-defeating	self-perpetuating
self-delusion	self-pity
self-destruction	self-pollution
self-discipline	self-preservation
self-effacement	self-protection
self-employed	self-reproach
self-examination	self-sealing
self-fertilization	self-support
self-help	self-supporting
self-imposed	self-sustaining

self-ad-dressed' adj. addressed to oneself /in self-addressed envelope/

self-as-sur'ance n. confidence in oneself —*self-assured' adj.*

self-cen-tered adj. concerned only with one's own affairs; selfish

self-con'ceit' n. too high an opinion of oneself; vanity

self-con'fidence n. confidence in one's own abilities, etc. —*self-con'fident adj.*

self-con'scious adj. unduly conscious of oneself as an object of notice; ill at ease —*self-con'sciously adv.* —*self-con'sciousness n.*

self-con-tain'd adj. 1 keeping one's affairs to one self 2 showing self-control 3 complete within itself —*self-con'tra-dict'ion n.* 1 contradiction of oneself or itself 2 any statement containing elements that contradict each other —*self-con'tra-dic'tory adj.*

self-con'trol' n. control of one's own emotions, desires, actions, etc. —*self-con-trolled' adj.*

self-defense' n. defense of oneself or of one's rights, beliefs, actions, etc.

self-de-fin'it'ial n. denial or sacrifice of one's own desires or pleasures

self-destruc't' vi. destroyer

self-deter'mi-na'tion n. 1 determination according to one's own mind; free will 2 the right of a people to choose its own form of government —*self-deter'mined adj.*

self-dis'cov'ery n. a becoming aware of one's true potential, character, motives, etc.

self-ed'u-ca'ted adj. educated by oneself, with little formal schooling

self-es-teem' n. 1 belief in oneself 2 undue pride in oneself; conceit

self-evi'dent adj. evident without need of proof or explanation

self-explain'alo'ry adj. explaining itself; obvious

self-expres'sion n. expression of one's own personality, esp. in the arts

self-full'fill'ing adj. 1 bringing about one's personal

VD venereal disease
VDT (vĕdĕ'tă') *n.* a video display terminal
 've have: used in contractions [*we've seen it*]
veal (vĕl) *n.* [*< L vitulus, calf*] the flesh of a young calf, used as food
vec-tor (vĕk'tor) *n.* [*< L *vehere*, to carry*] an animal that transmits a disease-producing organism
Veda (vă'dă, vă'-ă) *n.* [*Sans *veda*, knowledge*] any of four ancient sacred books of Hinduism —*Ve'dic adj.*
Veep (vĕp) *n.* [*also v-*] vice-president
veer (vir) *vt., vi.* [*< Fr *virer*, turn around*] to change in direction; shift; turn —*n.* a change of direction
veg-e-ta-ble (vĕj'ĕ tă băl, vĕj'ĕtăb'ĕl) *adj.* [*see VEGETATE*] 1 of plants in general 2 of, from, or like edible vegetables —*n.* 1 any plant, as distinguished from animal or inorganic matter 2 a plant eaten whole or in part, raw or cooked
veg'e-tar'ian (-ter'ĕ ān) *n.* one who eats no meat —*adj.* 1 of vegetarians 2 consisting only of vegetables
veg-e-tate (vĕj'ĕ tăt') *vi.* -tat'ed, -tat'ing [*< L *vegere*, quicken*] 1 to grow as plants 2 to lead a dull, inactive life —*veg'e-tative adj.*
veg'e-ta-tion *n.* 1 a vegetating 2 plant life in general
ve-he-men-té (vă'mĕnt) *adj.* [*< L *vehere*, carry*] 1 violent; impetuous 2 full of intense or strong passion —*ve'hē-mence* or *ve'hē-mency* *n.* —*ve'hē-men-tly* *adv.*
ve-hi-cle (vĕ'kăl) *n.* [*< L *vehere*, to carry*] 1 any device for carrying or conveying persons or objects 2 a means of expressing thoughts, etc. —*ve-hic'u-lar* (-hik'yoo lär) *adj.*
veil (vĭl) *n.* [*< L *velum*, cloth*] 1 a piece of light fabric, as of net, worn, esp. by women, over the face or head 2 anything used to conceal, cover, separate, etc. /*veil of silence*/ 3 a part of a nun's headdress —*vt.* 1 to cover with a veil 2 to hide or disguise —*take the veil to become a nun*
veiled (văld) *adj.* 1 wearing, or covered with, a veil 2 concealed, hidden, etc. 3 not openly expressed
vein (vĭn) *n.* [*< L *vena**] 1 any blood vessel carrying blood to the heart 2 any of the ribs of an insect's wing or of a leaf blade 3 a body of minerals occupying a fissure in rock 4 a lode 5 a streak of a different color, etc., as in marble 6 a distinctive quality in one's character, speech, etc. 7 a mood —*vt.* to mark as with veins
Vel-cro (vĕl'krō) trademark for a nylon material for fastenings, made up of matching strips with tiny hooks and adhesive pile, that are easily pressed together or pulled apart
veild or veildt (velt) *n.* [*Afrik < MDu *veild*, field*] in South Africa, open grassy country, with few bushes or trees
veil-lum (vĕl'om) *n.* [*< L *vitulus*, calf*] 1 a fine parchment prepared from calfskin, lambskin, etc., used for writing on or for binding books 2 a strong paper made to resemble this
ve-lo-c-i-ty (vă lüs'ĕ tē) *n., pl. -ties* [*< L *velox*, swift*] 1 quickness of motion; swiftness 2 rate of motion in a particular direction in relation to time
ve-lour or ve-lours (va loor') *n., pl. -lours' (-loorz', -loor')* [*Fr < L *villus*, shaggy hair*] a fabric with a soft nap like velvet
ve-lum (vă'lom) *n., pl. -la (-la)* [*L, a veil*] SOFT PALATE
vel-vet (vĕl'vĕt) *n.* [*< L *villus*, shaggy hair*] 1 a rich fabric of silk, rayon, etc. with a soft, thick pile 2 anything like velvet in texture —*adj.* 1 made of velvet 2 like velvet —*vel'vet-y adj.*
vel'vet-een' (-va tĕn') *n.* a cotton cloth with a short, thick pile like velvet
ve-nal (vă'năl) *adj.* [*L *venalis*, for sale*] open to, or characterized by, bribery or corruption —*ve'nat-ly* *adv.* —*ve-nal-ty* (vă'năl'ĕ tē) *n.*
vend (vĕnd) *vt., vi.* [*< L *venum dare*, offer for sale*] to sell (goods) —*ven'dor* or *ven'der n.*
ven-det-ta (ven det'a) *n.* [*It < L *vindicta*, vengeance*] a bitter quarrel or feud, as between families
vending machine a coin-operated machine for selling certain small articles
ve-neer (vă nir') *vt.* [*< Fr *fournir*, furnish*] to cover with a thin layer of more costly material; esp., to cover (wood) with wood of finer quality —*n.* 1 a thin surface layer, as of fine wood, laid over a base of common material 2 superficial appearance /*a veneer of culture*/
ve-ne-ra-ble (vĕn'ĕr ă băl) *adj.* worthy of respect or reverence because of age, dignity, etc. —*ve-ne-ra-bil-ity* *n.*
ve-ne-ri-ate (vĕn'ĕr ăt') *vt.* -at'ed, -at'ing [*< L *venari*, to worship*] to look upon with feelings of deep respect; revere —*ve-ne-ra-tion n.*
ve-ne-re-al (vă nir'ĕ ăl) *adj.* [*< L *venus*, love*] 1 of sexual intercourse 2 transmitted by sexual intercourse /*venereal disease*/
Ve-ne-tian (vă nĕ shăn) *adj.* of Venice, its people, etc. —*n.* a native or inhabitant of Venice
Vene-tian blind [*also v- b-*] a window blind of thin, horizontal slats that can be set at any angle
venge-ance (ven'jĕns) *n.* [*< L *vindicare*, avenge*] the return of an injury for an injury, as in retribution; revenge —with a vengeance 1 with great force or fury 2 excessively
venge-ful (ven'jĕl) *adj.* seeking vengeance; vindictive —*venge-fully* *adv.*
ve-nial (vĕn'yāl, vĕ'nē ăl) *adj.* [*< L *venia*, a grace*] that may be forgiven; pardonable /*a venial sin*/
ve-ni-re-man (vă nĕr'ĕ man) *n., pl. -men* [*ML *venire facias*, cause to come*] one of a group of people from among whom a jury will be selected
veni-son (ven'i zan, -son) *n.* [*< L *venari*, to hunt*] the flesh of a deer, used as food
venom (ven'om) *n.* [*< L *venenum*, a poison*] 1 the poison secreted by some snakes, spiders, etc. 2 malice
ven'om-ous *adj.* 1 full of venom; poisonous 2 spiteful; malicious
ve-nous (vĕn'os) *adj.* [*L *venosus**] 1 of veins 2 designating blood carried in veins
vent¹ (vent) *n.* [*< L *ventus*, wind*] 1 expression; release /*giving vent to emotion*/ 2 a small opening to permit passage or escape, as of a gas —*vt.* 1 to make a vent in or for 2 to give release to; let out
vent² (vent) *n.* [*< L *findere*, to split*] a vertical slit in a garment
ven-ti-late (vent'ĕl'ĕt') *vt.* -lat'ed, -lat'ing [*< L *ventus*, wind*] 1 to circulate fresh air in (a room, etc.) 2 to provide with an opening for the escape of air, gas, etc. —*ven-ti-la-tion n.*
ven-ti-la-to-r *n.* an opening or a device used to bring in fresh air and drive out foul air
ven-tral (ven'tral) *adj.* [*< L *venter*, belly*] of, near, or on the belly
ven-tri-cle (ven'tri kăl) *n.* [*see prec.*] either of the two lower chambers of the heart —*ven-tric'u-lar* (-trik'yoo lär) *adj.*
ven-trilo-quism (ven tril'ĕ kwiz'ĕm) *n.* [*< L, ventr, belly + *loqui*, speak*] the art of speaking so that the voice seems to come from a source other than the speaker —*ven-tril'o-quist n.*
ven-ture (ven'char) *n.* [*see ADVENTURE*] 1 a risky undertaking, as in business 2 something on which a risk is taken —*vt.* -tured, -tur'ing 1 to expose to danger or chance of loss 2 to express at the risk of criticism /*to venture an opinion*/ —*vi.* to do or go at some risk
ven'ture-some (-səm) *adj.* 1 inclined to venture; daring 2 risky; hazardous Also *ven'tur-ous* (-əs)
ven-ue (ven'ü) *n.* [*< L *venire*, come*] 1 *Law* a) the locality in which a cause of action or a crime occurs b) the locality in which a jury is drawn and a case is tried 2 the scene of a large gathering for some event
Ve-nus (vĕ'nos) 1 the Roman goddess of love and beauty 2 the brightest planet in the solar system; see PLANET
Venus' flytrap' a swamp plant with hinged leaves that snap shut, trapping insects
Ve-nu-sian (vă nĕ shăn) *adj.* of the planet Venus —*n.* an imaginary inhabitant of Venus